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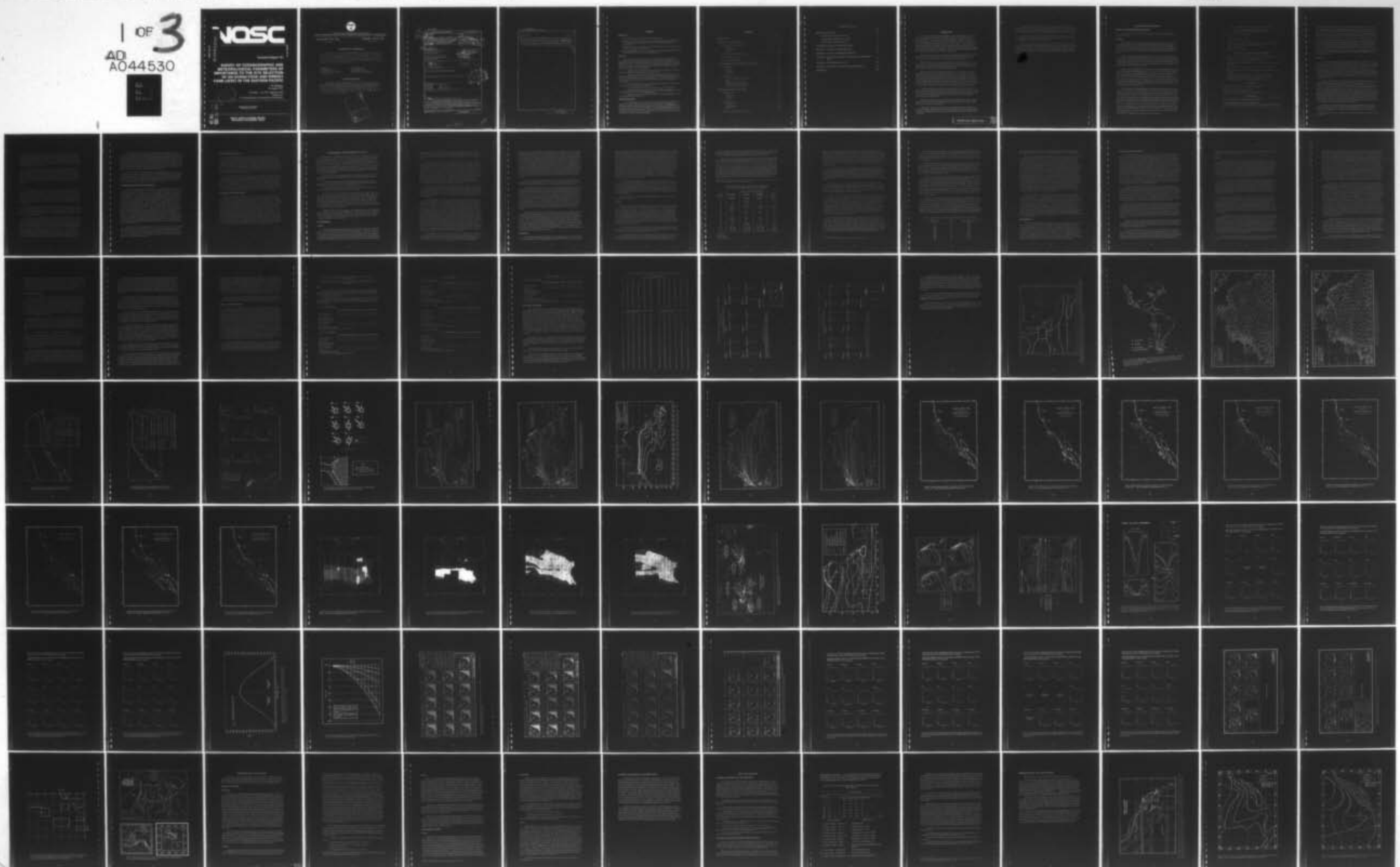

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Technical Report 121

SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORTANCE TO THE SITE SELECTION OF AN OCEAN FOOD AND ENERGY FARM (OFEF) IN THE EASTERN PACIFIC

PF Seligman

15 August 1977

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U.S. Energy Research & Development Administration

Approved for public release;
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Oceanographic and meteorological parameters necessary for selection of productive Ocean Food and Energy Farm (OFEF) sites are presented and compared for the eastern Pacific Ocean. Optimum values for biological, chemical, physical, and engineering requirements are estimated for both farm structures and the giant kelp Macrocystis pyrifera, the proposed OFEF crop plant. From these data, requirements, and limitations, preliminary site selection criteria are established. → next page

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Selection candidate Phase 1 OFEF and future farm sites are given after a thorough review of pertinent data and literature. It is determined that within the area studied, the southern California offshore region from approximately 32°30'N to 34°30'N is best suited for siting preliminary Ocean Farms. Detailed maps and tables of currents, ocean temperatures, winds, nutrient concentrations and other parameters are presented.

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SUMMARY

OBJECTIVES

The principal objectives of this site selection project are to:

- establish preliminary site selection for an ocean food and energy farm (OFEF) based on the requirements and limitations of OFEF as delineated by the principal investigators;
- compile a digest of oceanographic and meteorological data useful to the selection of the Phase 1 and future farm sites; and
- select candidate Phase 1 sites after a thorough review of pertinent data and literature, and report these sites in order of increasing importance.

RESULTS

Site selection criteria and requirements are developed and are listed. Pertinent oceanographic and meteorological data are given in tables, figures and appendices. By comparing these criteria to the available environmental data, the southern California offshore region from 32°30'N to 34°30'N was chosen as the most suitable preliminary site for OFEF. This area has been selected as the optimal location for Phase 1, and probably for Phase 2 and early 3 as well, for the following reasons.

1. The sites chosen are within the U.S. economic zone (increased to 200 miles in March 1977), thereby avoiding possible international conflict.

2. The region has the most mild and least severe extreme weather conditions of any offshore area within the economic zone of the continental United States or Hawaii. It has a very low occurrence of high velocity winds and high waves. This is because the region is north of the tropical cyclone zone and is located on the southern extreme of the extra-tropical cyclone region.

3. In this nearshore area, nutrients of adequate concentrations are relatively near the surface (15-25 μg-at/liter NO_3 at 100 meters).

4. Research and support facilities are available close to the proposed sites.

5. The region is within the natural habitat zone of <u>Macrocystis pyrifera</u>. Temperature and light regions are excellent for <u>Macrocystis</u> growth.

6. Current speeds are mostly within the ranges specified for optimal OFEF operations and kelp growth characteristics.

RECOMMENDATIONS

It is recommended that: (i) siting of Phase 1 and probably future ocean farms be within the southern California offshore region; (ii) further research on <u>M. Pyrifera</u> be performed to define nutrient and temperature requirements and possible synergistic effects for better definition of potential growing sites; (iii) other worldwide geographic locales be investigated for possible future siting of OFEF's; and (iv) that thorough current surveys be conducted at final sites prior to placement of farm. This is necessary for final engineering requirements and farm configuration planning.

CONTENTS

CONTENTS (Continued)

INTRODUCTION

The Ocean Food and Energy Farm (OFEF) concept envisions large areas of open ocean under cultivation utilizing solar energy input and the photosynthetic process to produce high yields of marine algae. The proposed crop plant, the giant brown kelp Macrocystis pyrifera, is expected to yield in excess of 270 wet metric tons (36 dry metric tons) of harvested organic material per acre per year (Refs. 1 and 2). This material would be harvested and processed to produce methane gas, food and feed products, fertilizer, ethanol, and other organic products, many of which are currently produced from nonrenewable petroleum sources (Ref. 3). In addition, a mariculture subsystem would produce high-value finfish and shellfish products for human consumption.

The economic success of any aquaculture system is dependent on the selection of an appropriate site. Factors which must be considered in selecting potential sites include various physical, chemical, biological, economic, and geopolitical parameters.

Proper selection of a farm site requires that the needs and limitations of the total farm system be considered. Particularly important are the biological requirements of the kelp Macrocystis pyrifera and the practical engineering and economic factors which affect design of the farm substrate and artificial upwelling systems.

Biological and chemical parameters of importance to site selection include the availability and concentration of nutrients in both the near-surface mixed layer (directly available to crop) and at intermediate depths (100 to 300 meters of depth and available to the crop after artificial upwelling). Nutrient concentration and availability in combination with light intensity and temperature are among the principal factors which will determine the rate of OFEF primary productivity and therefore, economic return. Nutrient concentrations are highly variable in both location and season with the principal determining factors being the amount of wind-caused mixing, natural upwelling, and biological utilization.

The cost of the substrate system will constitute a large part of the total cost of the OFEF. The substrate therefore "represents a major investment in an ocean structure which may be vulnerable to damage during periods of storm and adverse weather conditions" (Ref. 2). Selection of a farm site which minimizes the chance for environmental damage is consequently of great importance.

The location and intensity of prevailing currents are also important; areas of high-speed currents may have to be avoided whereas weaker currents can act to remove waste materials and replenish nutrient supplies.

Other aspects important to the farm location include the amount of incident solar radiation and degree of light penetration (both vary geographically), the ocean temperature in relation to M. pyrifera tolerance, and the location and concentration of potential sources of pollution.

Economic and geopolitical considerations are briefly addressed. The location of future support and processing facilities in relation to the farm site are important economic factors. Previously claimed or disputed territorial waters will be areas of high risk until international agreements are made. Location of traditional sea lanes must be considered.

The general region of the eastern Pacific was chosen for study because of the proximity of support facilities, the positive geopolitical environment, and the need to limit the area of preliminary consideration to a manageable size.

This report discusses the site selection for one or more Phase 1 prototype farms. The summary of available environmental data presented, however, are also applicable to the selection of future Phase 2 and 3 locations. Site selection is based on criteria as developed by the principal investigators for the OFEF Project and include Dr. W. North of the California Institute of Technology and Dr. H. Wilcox and Mr. D. Murphy of the Naval Ocean Systems Center.

OFEF SITE SELECTION CRITERIA

BIOLOGICAL REQUIREMENTS/LIMITATIONS

Site selection criteria dealing with the biological requirements and limitations are summarized in Table 1.

Nutrients

Surface waters of the open ocean in temperate and tropical areas beyond coastal and upwelling influences are generally nutrient-limited to the degree that the naturally available nutrients will sustain only low levels of productivity. It has been demonstrated that nitrogen is the principal controlling nutrient in the eastern tropical Pacific (Refs. 4 and 5) and is the primary nutrient limiting growth of phytoplankton off southern California (Ref. 6).

Studies of marine macroalgae productivity as a function of nutrient concentration are few. Waite and Mitchell (Ref. 7) have demonstrated that increases in the concentration of ammonia and phosphate significantly increase the rate of carbon fixation (photosynthesis) in Ulva lactuca, a green macroalgae. In the red alga Eucheuma, periods of maximum growth coincide with maximum nutrient concentrations during periods of lowered temperatures and reduced light along the Florida coast (Ref. 8).

Jackson states in his PhD thesis that for natural kelp beds (M. pyrifera) off San Diego "the condition most limiting Macrocystis production was the low concentration of dissolved nutrients, especially nitrogenous substances, near the surface" (Ref. 9). Nitrate concentrations in the San Diego Point Loma kelp bed were generally low, less than 1 μg-at/liter $NO_3 - N$* (Ref. 9), however, during upwelling periods can go as high as 5.8 μg-at in the near-surface (Ref. 10). There is evidence that M. pyrifera compensates for this nitrogen limitation by translocating it from depths where concentrations are significantly higher (Ref. 9). This characteristic is very significant and should be considered when designing the upwelling and distribution systems for the Ocean Farm.

Natural populations of M. pyrifera off southern California experience nitrate concentrations on the surface from near 0 μg-at/liter to as high as 9 μg-at/liter NO_3-N, but generally less than 4 μg-at/liter. At 8–10 meters depth the concentrations are usually higher, varying from about 1 μg-at to as high as 16 with a mean range of 2-6 μg-at NO_3-N (Refs. 9 through 12). Nutrient concentrations are usually highest in the January to June period and lowest in late summer. Growth rates have been observed to be decidedly low when dissolved nitrogen falls below 1.0 μg-at/liter (Ref. 13). Preliminary studies by W. North indicate that K_m for NO_3 (the concentration of nitrate at which the uptake velocity of nitrate is 1/2 maximum) is near 9.4 μg-at/liter (Ref. 13). Optimally, the concentration of nutrients should be above the K_m for maximal productivity. An area having a 10–15 μg-at/liter NO_3-N should yield a very high growth rate. Above this concentration the uptake rate curve levels off, therefore,

*1 μg-at/liter NO_3-N = 14 micrograms nitrate nitrogen/liter or 14 parts per billion (ppb).

Table 1. Ocean Energy Farm: summary of site selection criteria.

		BIOLOGICAL REQUIREMENTS/LIMITATIONS
1.		20° maximum mean surface temperature
2.	a.	3–5 μg-at/liter nitrate (minimum)
	b.	10–15 μg-at/liter nitrate (optimal)
3.	a.	25 cm/sec (0.5 kn) current maximum OFEF (⩾ 25 cm/sec sustained current causes plants to approach horizontal at substrate depth)
	b.	Optimal: 10 cm/sec (0.2 kn)
	c.	Minimal: 4 cm/sec (0.08 kn)
		ENGINEERING LIMITATIONS/REQUIREMENTS
1.	a.	0.5-m/sec (1-kn) current at substrate depth (Phase 1 operational current)
	b.	Maximum 1.5-m/sec sustained current design limitation
2.	a.	Avoid storm-force winds (greater than 25 m/sec) (locate in area of least storm probability)
	b.	Minimize gale-force winds (greater than 17-m/sec, 5.5-meter waves)
3.	a.	Maximum significant wave height 11 meters (35 feet) (design for Phase 1 test module)
	b.	Extreme wave height 19 meters (63 feet) (extreme design wave)
	c.	Minimum mean wave height 1 meter (required for upwelling system)
		Optimal wave height 2–3 meters (for upwelling system)
		ECONOMIC
1.		Moored substrate – maximum depth 600 meters (Phase 3)
2.		Proximity to research and support facilities Phase 1: 32-kilometers maximum (2-hour transit time)
		GEOPOLITICAL
1.		Avoid traditional sea lanes and submarine transit zones
2.		Locate outside claimed economic and territorial zones (probably 320-kilometer zones will be adopted – needs international clarification)

providing the plants with greater than 15 μg-at-NO_3-N would probably not be economical (e.g., an increase from 16 to 23 μg-at/liter only causes an increase in uptake rate of 12 percent, Ref. 13). Minimum levels of NO_3 required for the marine farm are estimated to be between 3 and 5 μg-at/liter (an increase in uptake rate of 400 percent is computed when NO_3 levels are increased from 1 to 5 μg-at/liter from W. North data, Ref. 13), since average levels of NO_3 off the southern California coast at depths between 100 and 300 meters vary from 15 to 30 μg-at/liter. If the nitrate required by M. pyrifera is between 3 and 15 μg-at/liter, then the estimated amount of upwelled water to provide this level of nutrient to the plants is between 10 and 50 percent assuming thorough mixing of upwelled with surface waters. A very important parameter discussed by North (Ref. 13), is the percentage of surface area of kelp that is exposed to given levels of NO_3. This factor should be considered in the design of the distribution system. If exposure area on the M. pyrifera can be maximized, then the concentration of NO_3 might be reduced significantly while maintaining adequate growth rates.

Temperature

In most biochemical systems, increases in temperature cause increases in chemical reaction rates to some maximal temperature level beyond which inhibition occurs. Temperature is found to be very important in modifying kelp growth rate. Comparison of elongation growth rates measured at different temperatures yield a Q_{10}* of approximately 1.7 for M. pyrifera (Ref. 14). This indicates that the expected increase in frond elongation for a 10°C rise in temperature is by the factor 1.7. However, M. pyrifera off southern California does poorly at temperatures above 20°C, and when above 25°C the symptoms of "temperature damage" (pigment loss, brittleness, sloughing) appear in a week or less (personal communication, W. North).

Clendenning studied the effect of short-term exposures to high temperatures and found that light-saturated photosynthesis was always highest between 20° and 25°C (Ref. 15). At 30°C photosynthesis was completely inactivated within the first hour of exposure in kelp collected from depths of 15 to 20 meters, and it was partially inactivated in one hour in kelp collected from the surface canopy. In longer term experiments at 23.9°C (75°F), M. pyrifera showed a decrease in photosynthetic capacity after one day and severe degradation of the plant after two days (Ref. 15). M. pyrifera from Bahia Tortugas, Baja California, flourishes in water that reaches approximately 26°C for several weeks during late summer (W. North, personal communication). Clendenning demonstrated that the photosynthetic temperature optimum for the Turtle Bay kelp was between 25° and 30°C. These plants also exhibited a 50-percent-higher photosynthetic capacity per unit area than has been observed in local southern California kelp (Ref. 15).

Studies on the effect of temperature on M. pyrifera growth have not generally included nutrient measurements. In the reported cases where there has been a summer die-off of kelp, allegedly caused by higher than normal temperatures, nutrient data are

**Temperature coefficient. The increase in rate of a process (expressed as a multiple of initial rate) produced by raising the temperature 10°C.*

sparse or unavailable. Warmer surface water from the south is very low in nutrients, and when there is an intrusion of this water along the southern California coast, it is possible, if not probable that the plants suffer from nutrient deficiency rather than high temperature degradation, or perhaps there is a synergistic effect. An experiment to investigate the combined nutrient and temperature effects on the growth rate of M. pyrifera must be completed to better define temperature and nutrient limitations and thus more accurately characterize potential ocean farm geographic ranges.

The initial sustained temperature limitation is therefore tentatively put at 20°C. Temperatures above this value appear to have a degrading effect on the kelp off southern California and this area will probably be the first source of plants for early experimental farms. The 20°C assumed limiting temperature may eventually be increased if southern (Bahia Tortugas) plants are used or if genetic manipulation in the future creates strains of greater temperature tolerance. (Note: Figure 11 shows the approximate ranges of Macrocystis if limited to 20°C and with varying amounts of surface cooling from artificial upwelling.)

Currents

The magnitude of the current field to which the proposed marine farm is exposed is of great importance to its overall success. Currents of high velocities relative to the substrate will entail high cost structures and will tend either to cause the kelp to trail horizontally at or near the depth of the substrate, thus reducing light level and productivity. In extreme conditions such currents might cause the plants to break away. In combination with high waves they could cause damage to the substrate structure itself. Conversely, a low velocity water movement is required to replenish nutrients in the vicinity of the plants and carry off waste products.

Besides major current systems, other forms of water movement are important. These include local wind-derived currents, swell and chop, internal waves, and natural and artificial upwelling. Artificial upwelling may become very important as a water movement factor in a large marine farm where the other forms may be severely diminished by the frictional characteristics of the plants (Ref. 16).

Preliminary experiments at the University of California, Santa Barbara, indicate that for tissue excised from adult Macrocystis, a maximum photosynthetic rate (ml O_2 evolved/ cm^2 blade/hr) is observed with a water velocity of 10 cm/sec or approximately 0.2 knot (W. Wheeler, personal communication). In several as yet unpublished experiments, W. Wheeler utilized a variable flow-through system to measure the O_2 evolution from Macrocystis tissue while keeping nutrients and light levels constant. The rate of photosynthesis with no water movement was measured to be approximately 1/5 that at 10 cm/sec. At a velocity of 4 cm/sec (0.08 knot) the photosynthetic rate was 1/2 maximum. It is apparent from these experiments that some degree of water movement is required to increase nutrient availability, and thus the rate of photosynthesis, above that supported by purely diffusive processes.

The optimum current velocity recommended for the Ocean Farm is 10 cm/sec (0.2 knot). An absolute minimum sustained velocity of 4 cm/sec (0.08 knot) is recommended. These recommendations are for mean water speed past the kelp plants and are tentative until more thorough experiments can be accomplished. The important parameter is relative water speed which can be the combined result of current, swell, internal waves, and upwelling. If factors other than primary current create an adequate water flow, the site could successfully be located in an area where current velocity is reduced below the levels listed above as minimum. Some degree of water movement is necessary, however, to ensure an interchange of nutrient-depleted, high-waste-concentration water with fresh water.

At the other extreme, sustained currents of relatively high velocity can be destructive to the plants or cause them to trail horizontally, thus reducing their photosynthetic capacity by reducing available light. Currents above 25 cm/sec (0.5 knot) tend to cause mature M. pyrifera to trail towards the horizontal, approaching the depth of their substrate (W. North, personal communication). For this reason, the maximum, mean sustained relative current that can be tolerated within the marine farm is taken as 25 cm/sec.

ENGINEERING LIMITATIONS/REQUIREMENTS

The preliminary design criteria for a moored ocean farm grid system for Phase 1 and 2 farms have been delineated (Ref. 17). The wind is the principal driving force behind most environmental parameters of importance to structural integrity. Although the wind itself has a negligible effect on submerged substrates and kelp plants and is not considered in the engineering criteria, it is the driving force for both wave height and localized currents. Because wind is more frequently measured than other parameters it is discussed here and in more detail in the meteorology section. For design purposes, the maximum significant wave height (significant height defined as average height of the 1/3 highest waves) is set at 11 meters (35 feet) (the extreme wave height is set at 19 meters) and the significant period set at 12.6 seconds. The design operational current is an omnidirectional 0.5 m/sec, with a maximal total design current of 1.5 m/sec. Above 1.5 m/sec relative current the kelp plants begin to come apart (W. North, personal communication). These engineering criteria were defined after using a single cable dynamic load model with the worst case defined as the substrate at a 15-meter depth experiencing 11-meter waves with the peak load approximately 2.8 m/sec (effect of 0.5-m/sec current plus action of waves) (Ref. 17). In order to avoid maximum wave heights and currents as delineated above and in Table 1, areas considered for locating the marine farm should be as free as possible of gale-force winds (greater than 17 m/sec) and should be positioned to avoid (minimize probability of occurrence) storm-force winds (25 m/sec or greater).

At present, wave-powered pumps appear to be the most promising means of delivering high-nutrient water to the farms (Ref. 18). First estimates indicated that a minimum mean wave height of 1 meter is required to pump sufficient water to maintain desired nutrient levels. A wave height of 2 to 2.5 meters is preferred to supply enough energy to upwell the deep water needed to fertilize one acre (4000 square meters) of ocean farm with one pump utilizing a 3-meter-diameter float (Ref. 18).

ECONOMIC REQUIREMENTS

It is presently planned to have Phase 1 and 2 farms in the form of moored grids while the feasibility of dynamically positioned farms is being studied. One of the most important economic parameters when considering anchored substrates is the cost of mooring and mooring materials. It is currently not feasible to place multipoint mooring anchors and lines for large OFEF substrates below about 600 meters in depth because of the extreme rise in costs beyond that depth (H. Wilcox, personal communication). This cost factor will limit moored farms to approximately the 700-meter contour. Early experimental farms will require much smaller mooring systems and are governed by different economic pressures, allowing them to be moored at deeper depths.

A second cost factor related to site selection is the proximity of logistic and support facilities. For Phase 1 sites, a distance of approximately 32 kilometers (2-hour transit time) to support facilities is considered maximum due to the significant amount of experimental effort and support required for these early prototype farms. For future Phase 2 farms, the distance to support facilities might be increased to approximately 80 kilometers; however, there is potentially a bottom depth constraint. Phase 3 and future farms may have support facilities incorporated into the farm itself and so it may be economically feasible for the site to be three to several hundred kilometers from the final processing centers on land.

GEOPOLITICAL CONSIDERATIONS

The selection of an appropriate site must take certain geographical and political factors into account. Traditional sea lanes and submarine transit zones should be avoided to prevent navigational hazards. Until international agreements are made, the site will have to remain outside the claimed economic and territorial zones of other nations. It is probable that in the near future most of the countries of the world will claim 322-kilometer (200-mile) economic zones. Many of the countries of South and Central America have already claimed 322-kilometer economic zones; some, including Brazil and Ecuador, have claimed 322-kilometer territorial limits. Mexico has recently (effective July 1976) claimed a 322-kilometer economic zone, restricting significantly the southern areas where marine farms might be placed, at least until agreements can be made with Mexico. Dr. Arvid Pardo of USC, a convener of the Law of the Sea Conference, has strongly recommended that marine systems (such as the Food and Energy Farm) be maintained within the U.S. economic zone, which is currently 19 kilometers (12 miles), but likely will soon (March 1977) be extended to 320 kilometers, unless prior international agreements are made concerning the utilization of open ocean (unclaimed) areas (Dr. B. Anderson, personal communication).

OCEANOGRAPHIC AND METEOROLOGICAL SURVEY

The world oceans, including adjacent seas, encompass over 361 million square kilometers (139 million square miles) of surface area with a tremendous diversity of environmental conditions (Ref. 19). Because of the need in this preliminary study to limit the site survey area to a manageable size, the eastern Pacific Ocean from 50°N to 10°S latitude and from the west coast of the Americas to Hawaii (160°W longitude) was chosen (Fig. 1). This area encompasses approximately 36 million square kilometers (14×10^6 mi^2) or 10 percent of the world ocean (20 percent of the Pacific Ocean). This area, particularly the northeastern Pacific, is highly appropriate to study for potential ocean farm sites for several reasons, some of which are listed below.

1. Much of the area is within operating range of scientific and support facilities of personnel who have been involved in Macrocystis research and other aspects of the Ocean Farm Project.

2. The northern distribution of the genus Macrocystis, the proposed ocean farm organism, falls within this area (Fig. 2). Therefore, at least in the nearshore environment, the ecological requirements for the growth of Macrocystis are met.

3. The general oceanographic/meteorological climate in much of the survey area appears to be moderate enough to allow large open ocean farms.

The survey area was initially divided into eleven natural oceanic regions, (Ref. 20, Fig. 1, A-K) which are based on the properties of surface waters, their biology, currents, and current boundaries, rather than classical oceanic water masses which are based primarily on deep water characteristics (Ref. 19). Within these natural oceanic regions, 20 geographic areas were picked as representative portions of the whole region. These areas were then analyzed using National Oceanographic Data Center data tapes on the Naval Ocean Systems Center (NOSC) Univac 1110 computer. Temperature, salinity, density, and nutrient profiles for the representative areas were produced.

In addition, these areas were surveyed for meteorological data by the Naval Weather Service Detachment at the Environmental Data Service, National Climatic Center, Asheville, North Carolina. Other environmental parameters and informational sources were utilized to characterize the regions, to eliminate areas which were significantly beyond the defined criteria, and finally to select optimal sites.

OCEANOGRAPHY

Currents

The general current regimes (direction and mean velocities) are given for summer and winter for the north Pacific Ocean in Figs. 3 and 4, respectively. The principal current in the area of the survey is the California Current. This current has a rather poorly defined and variable southerly flow which is easily influenced by prevailing winds. The California Current starts its southerly movement at 45° to 48°N at a position where the North Pacific and Aleutian (Subarctic) Currents impact the coast. The current varies in width from about

400 kilometers (250 mi) off Washington to 720 kilometers (450 mi) off southern California (Fig. 5). The California Current turns westerly between 20° and 25°N and becomes the North Equatorial Current with mean speeds between 15 and 30 cm/sec to the longitude of Hawaii.

Overall, the California Current averages about 15 to 30 cm/sec (Figs. 3 and 4). The southward flow, particularly near the coasts (areas C and D in Fig. 5), predominates from March through September. During the months October to February the weak northward moving Davidson Current predominates near the coast. Even during the summer months, when the current is most stable, it tends to be variable. In region A the current sets directly south 23 percent of the time; all other directions average about 10 percent (Ref. 28). In region B the current becomes more consistent, setting between the southwest and southeast 48 percent of the time with little or no secondary flow. The speeds in sections A and B, as listed in Fig. 5, vary from 0.15 to 1.1 m/sec. The maximum speeds (above 0.6 m/sec) are probably somewhat high because they are mostly based on ship drift measurements on which prevailing winds can have a highly significant effect. In region C the nearshore currents are higher in velocity and more consistent than in region D.

During the winter months (November to February) the prevailing current direction in regions C and D in the California Current region (Fig. 5) shifts northward and is called the Davidson Current (Fig. 6), which can be termed more accurately the Winter Coastal Countercurrent (Ref. 28). It has a rather poorly defined variable flow dependent mainly on the influence of the wind. Figure 6 shows the boundary within which the prevailing northward flow generally occurs.

The table with Fig. 6 indicates the variability of flow by showing monthly percent frequency of observations of speed and direction. The Davidson Current is interrupted by the prevailing southerly flow of the California Current from March through the first half of October. The southern portion of the current (Fig. 6, region B) is more variable than the northern part, with sets occurring in the opposite direction (south) frequently in January and February. There is evidence that there is a permanent northward flow below 200 meters of depth running about 64 kilometers wide at speeds of about 25 cm/sec. It is probable that when northerly winds become weak or negligible in late autumn and winter, a north-setting countercurrent forms at the surface inshore of the main California Current. During this period coastal upwelling lessens (upwelling is strongest in the spring and early summer months), and numerous irregular eddies occur along the coast (Refs. 28 and 29). Nearshore currents may be influenced by coastal tidal currents (which are rotary and thus will set in all directions) and by the local winds, hence will tend to have a highly variable nature. In summary, the Davidson Current begins at about 32°N, is variable and weak in the southern section (10 to 25 cm/sec), but becomes more constant as it moves northward. In the northern section it averages slightly higher speeds (20 to 35 cm/sec) and meets the more swiftly northern-moving Alaska Current (25 to 50 cm/sec) at about 48°N.

Current profile (velocity with depth) measurements are relatively sparse. However, this type of information is extremely important to the planning and development of the ocean farm because of the need to design substrate and mooring systems to withstand current and current shear. Figure 7 gives several current profiles for the northeast Pacific

region. As can be seen in the figure, current measurements are highly diverse and vary from rather high surface speeds, 25 to 120 cm/sec, in the northern portion near the coast (profile 8-11) to the very low speed currents, less than 10 cm/sec, at 35°N (profile 14). The northern area (48° to 52°N) is the terminus of the Aleutian Current and the southeastern portion of the northward-moving Alaska Current. In locations 8 and 9 the current remains near the same velocity or increases with depth; there may be some tidal influence from the inlet north of Vancouver Island. Slightly further south the strong surface currents (greater than 1 m/sec in locations 10 and 11) are reduced to nearly 25 cm/sec by 25-meter depths. It is probable that these rather high maximum surface current speeds were wind-induced (wind velocities are not given). The measurement locations off the continental slope (locations 12, 13, and 14) are relatively low (10 to 20 cm/sec) in current speed and nearly constant with depth. In the southern portion of the California Current region the profiles show slow (5 to 15 cm/sec) surface currents that decrease in speed slowly with depth or remain roughly constant.

The need for further current time histories and depth profiles is apparent. Prior to placement of the prototype marine farm, current velocity profile measurements should be made to estimate better the probable stresses on the substrate and upwelling systems.

In the central portion of the survey area, northeast of Hawaii, a large gyre is formed during the summer from the forces of the weak easterly-moving North Pacific Current, the southerly California Current, and the relatively strong westerly-setting North Equatorial Current (25 to 50 cm/sec, 13° to 18°N). The current flow in the central gyre area is relatively slow, (5 to 15 cm/sec). The gyre tends to disappear in the winter (Fig. 4). Further to the south, the North Equatorial Countercurrent runs steadily towards the east at 25 to 50 cm/sec from about 5° to 7°N. At the point of the northward deflection of the countercurrent as it impinges on the coast of Central America, there is a redistribution of mass that is effected by divergence and crosscurrent flow thus causing an upwelling zone about 400 kilometers across (Refs. 24 and 25). This zone is termed the Costa Rica Dome and is characterized by lower near-surface temperatures and elevated nutrient concentrations (see Fig. 1).

From approximately 4°N to 1°S the high-velocity South Equatorial Current sets in a westerly direction with speeds up to 1 m/sec near the equator. The South Equatorial Current originates principally from the Peru Current, which moves up the coast of South America with a mean velocity of approximately 30 cm/sec in the region of 10°S increasing to about 45 cm/sec in the northern portion where it turns west (regions 9 and 10, Fig. 8) at about 3°S. The surface current velocity is roughly constant both seasonally and over most of its length. Slight seasonal changes are shown in Fig. 8. The current close inshore is under the nearly continuous influence of small-scale upwelling (Ref. 28). The upwelling takes place from about 130 meters from 35°S to 2°S (Ref. 29) and causes lower temperatures and increased nutrient concentrations near the coast.

Temperature

Temperature is important biologically for two principal reasons: (1) it has a stimulatory effect on the growth rate of Macrocystis as the temperature increases from low values,

and (2) it may have an inhibitory effect when the temperature rises above 20°C for northern strains of M. pyrifera (somewhat higher than 20°C for the southern, Baja California, plants). A most important parameter, in terms of selecting an Ocean Food and Energy Farm site, is the maximum temperature reached during the summer months. Figure 9 gives the mean temperature of the north Pacific for September; generally, the warmest water temperatures are observed during this month. The mean 20°C isotherm (68°F) runs eastward from the western Pacific very close to 40°N latitude to approximately 150°W where it bends southward meeting the west coast at about 32°N, just south of San Diego (Fig. 9). This southern bending of the isotherms along the west coast is caused by significantly cooler temperatures resulting from the southerly movement of the cold California Current; during some months, the effect of coastal upwelling intensifies the cooling trend. Figure 10 gives the surface thermal structure for maximum September temperatures. The thermal configuration is basically the same (as Fig. 9) except the warmer isotherms are extended further to the north. The 20°C maximum isotherm runs across the Pacific at 43°N, bends southward at 130°W, and meets the coast at about 39°N.

The selection of the Ocean Farm site, again, is dependent on the surface thermal structure, to the extent that (1) Macrocystis is temperature-limited (needs further research), (2) the degree of optimization of growth rate desired, and (3) the surface water can be cooled with artificial upwelling. Considering point (3) above, Fig. 11 shows the incremented temperature reduction of surface waters, by artificial upwelling, required to lower the mean ambient September temperature to 20°C, the estimated sustained upper temperature limit for M. pyrifera.

Figures 12 and 13 give the mean and minimum temperatures, respectively, for the north Pacific for February.

Nutrients

Most open ocean areas under consideration for the OFEF are nutrient-limited (Refs. 4, 5, and 6), given the selection criteria delineated in Table 1 (3-5 μg-at/liter nitrate minimum, 10-15 μg-at/liter optimum). Even in the nearshore environment where Macrocystis grows, the nitrogen concentration is frequently limiting (Ref. 9). It seems apparent that artificial fertilization (probably by upwelling pumps) will be necessary at most sites (Refs. 3 and 18). The geographic distribution of nutrients (both horizontally and vertically) is a very important parameter that must be considered in the OFEF site selection process. Because there is strong evidence that nitrogen is the principal macro-nutrient that is limiting to Macrocystis and because other nutrients generally occur in constant ratios to nitrogen, NO_3 is the only nutrient surveyed below.

In general, nitrate concentrations at the surface are less than 1 μg-at/liter except for certain near-coastal areas where natural upwelling occurs and two major upwelling areas, the Costa Rica Dome and equatorial upwelling zone shown in Fig. 1.

National Oceanographic Data Center data tapes were surveyed for nitrate profiles; these data are presented in Appendix A. In areas 1 through 9 and 15 (Fig. 1), NODC nutrient data were unavailable. Because nutrient data are strongly correlated with thermal structure, a

review of temperature profiles is given in Appendix B. For those areas where nutrient data are lacking, a qualitative estimate of the depth from which artificial pumping will be necessary can be made by determining the depth of the bottom of the thermocline.

The nutrient profiles in Appendix A are divided into four seasons, winter (Jan-Mar), spring (Apr-Jun), summer (Jul-Sep), and fall (Oct-Dec). Table 2 gives the depth range at which a concentration of 30 μg-at/liter NO_3 can be expected for the survey area given. In the northern sector of the study area (area 12, Fig. 1), surface nutrients are relatively high (1-6 μg-at/liter) in the winter, probably caused by heavy wind mixing and low biological utilization. At 100 meters of depth, nitrate concentration varies from about 12 to 25 μg-at/liter, and this increases gradually to 20-35 μg-at/liter at 300 meters of depth (Fig. A.3*). During the other seasons, particularly summer, the near-surface nitrate concentrations (upper 50 meters) are consistently low, being generally below 1 μg-at/liter. This fact is probably caused by the increased biological productivity found in the mixed surface layer

*In Figures A.3 to A.6 the reduced nitrate values (all from a single research cruise) which form an astatistical profile to the left of the main profile appear to be incorrect data and should be ignored.

Table 2. Depth range at which a concentration of 30 μg-at/liter nitrate can be expected for seasons in the areas surveyed.

AREA+	Depth in meters of 30 μg-at/liter			
	WINTER	SPRING	SUMMER	FALL
1-9	200-300	200-300	200-300	200-300
10	N	250-350	N	N
11	N	150-250	N	N
12	100-200	100-250	150-300	100-250
13	*450	N	N	N
14	*325	*500	*475	N
15	N	N	N	N
16	*325-450	*500	*475	N
17	100	N	N	N
18	N	*250-300	N	N
19	100-500	120->500	100->500	>300
20	225-350	200->500	100->500	250-350

* *Data sparse*

N *Data not available*

\+ *Areas defined in Fig. 1.*

(Ref. 31). As the mixed layer increases in depth, the maximum concentration of phytoplankton (microalgae) gradually deepens, leaving a zone of nitrate-deficient water between it and the upper pycnocline.* North of 45°N, nitrate remains at relatively high concentrations throughout the year. South of 45°N, nitrate is present at the surface during winter and late fall but becomes depleted in spring and summer. The maintenance of relatively high concentrations of nitrate north of 45°N is attributed to relatively intensive entrainment of deep water in to the upper zone coupled with a slow rate of removal of nutrients by primary producers (Ref. 31).

For areas south of 40°N in the eastern Pacific Ocean there have been two major surveys of nutrient and other oceanographic parameters. The California Cooperative Oceanic Fisheries Investigation Program (CALCOFI) has been studying oceanic properties on the California Current region from approximately 40°N to 20°N since 1950 and the Eastern Tropical Pacific (EASTROPAC) cruises were fielded during 1967 and 1968 to survey the tropical and subtropical eastern Pacific from about 25°N to 20°S and from the coast west to 130°W.

Near-surface nutrient concentrations from 40°N to about 35°N tend to be low during spring and summer but with slightly higher concentrations in the winter. Concentrations of 30 μg-at NO_3-N/liter are generally located between 150 and 300 meters of depth. Figure A.2 shows nitrate levels increasing rapidly from near 0 μg-at/liter at about 50 meters of depth to 20-25 μg-at NO_3/liter at 200 meters in area 11.

South of 35°N, near-surface NO_3 concentrations tend to be very low, 0.1 μg-at/liter or less. Figures 14-17 (from CALOFI Atlas, Ref. 32) show the nitrate concentrations at 10 meters for the four seasons. Near-shore concentrations can be very high in certain areas along the Baja California and California coasts during the spring and summer upwelling periods. Concentrations as high as 16 μg-at/liter NO_3-N are observed at Pt. Eugenia, 27° 30'N and Pt. Antonia, 30°N, both in Baja California; and at California's Pt. Conception, 34°30'N (Fig. 15, Ref. 32). Relatively high concentrations are observed off San Francisco in the fall (Fig. 17). South of 35°N, nitrate concentrations at distances greater than 8 kilometers off the coast are consistently low. Figures 18 through 21 show the seasonal concentration of NO_3 at 100 meters of depth.

Seasonal variations are not as apparent as areal trends. Nitrate concentrations at 100 meters of depth decrease from approximately 25 μg-at/liter at 35°N near the coast to about 5 μg-at/liter at 35°N but 240 to 300 kilometers farther west. To the south there is also a trend of generally decreasing nitrate concentrations but with higher values at greater depths. Figure A.1 shows three profiles for spring in area 10 (Fig. 1) taken in the vicinity of 27°N, 117°W. The nitrate concentration is at undetectable concentrations down to about 50 meters of depth, but then the concentration rapidly increases to between 7 and 22 μg-at/liter at 100 meters of depth and 30 μg-at/liter between 250 and 350 meters (Table 2).

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*Vertical zone of maximum density gradient; usually corresponds with the thermocline.

Areas further to the west (region 13, in the north Pacific gyral water, Fig. 1) show low surface concentrations which increase to 30 μg-at/liter NO_3-N at near 450 meters of depth. From limited data, there appears to be a seasonal near-surface increase of concentration from winter to summer (Figs. A.7 to A.9) to a value of approximately 1 μg-at in the spring and summer.

In Hawaiian offshore waters (area 14, Pacific north equatorial region, Fig. 1), near-surface nitrate concentrations are again low (less than 0.5 μg-at/liter) and do not reach 30 μg-at/liter levels until a depth of between 325 and 500 meters is reached (Figs. A.10 to A.12). Average nitrate levels for Hawaiian offshore waters are given in Table 3. There is little upwelling in the Hawaiian area except in some very localized near-shore sites; overall the area can be considered nutrient-limited.

In area 18, the western extreme of California water (Fig. 1), nutrient values are low in the upper 100 meters (less than 0.2 μg-at/liter) (Figs. B.54 through B.61). Nitrate levels of 30 μg-at/liter are reached at approximately 300 meters of depth. Further to the south (3°N to 15°N) in the North Equatorial Countercurrent region (region 17, Fig. 1), nutrient concentrations are again low in the upper 50 meters, but rise rapidly to between 15 and 25 μg-at NO_3/liter at 100 meters of depth. Below 100 meters, the concentration remains relatively constant, approaching 30 μg-at/liter at 250-300 meters of depth but in some measurements not going above 20 to 25 μg-at/liter at depths of 350 meters (Fig. A.13). In this area, therefore, little would be apparently accomplished by upwelling water artificially from deeper than 150 meters.

Further to the east, (area 19 in the southern portion of the west Mexican water), surface concentrations are low to about 30 meters of depth (Figs. A.16 to A.19). There are a few high surface values (between 2 and 7 μg-at NO_3/liter) during the winter (Fig. A.16), a phenomenon which might be caused by local wind-induced upwelling. Below 30 to 50 meters there is a very rapid increase in concentration which reaches 20-25 μg-at/liter at a depth of 100 meters. A nitrate concentration of 30 μg-at/liter is reached between 100 and 500 meters. Nitrate concentrations are generally directly related to the temperature profile (thermocline). Nutrient concentration increases rapidly near the base of the thermocline.

Table 3. Average nitrate concentration for Hawaiian offshore waters (Ref. 33).

DEPTH (m)	NO_3-N (μg-at/liter)
0	0.05
100	0.08
200	2.18
300	11.90
400	23.92
500	33.03
600	34.77

For example, during the fall in area 19, the thermocline is between 30 and 90 meters of depth (Fig. B.77) and the nitrate concentration rapidly increases over this range (Fig. A.18).

Area 20 in the Peru-Galapagos water (Fig. 1) is in the equatorial region (2°S to 3°N) west of the Galapagos Islands. This is an area of intense natural upwelling caused by a strong divergence at the equator which acts to bring water of low temperature and high nutrient concentration to the surface (Ref. 29). Figures 22 through 25 show nitrate-nitrogen levels for winter and summer at a depth of 10 and 100 meters for a major portion of the eastern tropical Pacific (Ref. 22). Ten-meter nitrate concentrations are highly elevated, averaging between 8 μg-at NO_3/liter (winter, Fig. 22) and 10 μg-at/liter (summer, Fig. 23). The equatorial upwelling region extends from the Peruvian and Ecuadorian coasts (from about 12°S to the equator) and in the westerly direction to at least 150°W (Figs. 1, 22, and 23). In region 20, 100-meter nitrate levels average from 15 to 25 μg-at/liter for winter (Fig. 24) and summer (Fig. 25). Concentrations as high as 40 μg-at/liter are observed southeast of the Galapagos (8°N 86°W) during the winter months (Fig. 24). Figures A.20 through A.24 give nitrate concentration profiles for area 20 for the four seasons. Surface concentrations are variable but high (maximum of 14 μg-at/liter in summer, Fig. A.21). Because of the upwelling, surface temperatures are significantly depressed (Figs. 9 and 10); during the summer and fall mean temperatures are 6° to 7°C lower in region 20 than in region 19 (Appendices B and C). Reduced temperatures and increased nutrients in the natural upwelling zones would, of course, allow for much reduced artificial upwelling rates and possibly eliminate the need for upwelling completely.

In summary, nutrient concentrations in the surface waters of the eastern Pacific Ocean are highly variable. Concentrations of nitrate-nitrogen are usually higher over the continental shelf because of localized upwelling and increased nutrient input from terrestrial runoff. Generally, nitrate concentration decreases in a westerly direction and the isonutrient depths increase. For example, in regions 1 through 9 the 30 μg-at/liter NO_3 depth is between 200 and 300 meters, in region 18 it is 250-300 meters, and near Hawaii (region 14) it is 325-500 meters. The trend is similar from north to south; there are higher surface concentrations seasonally north of 35°N. In more temperate waters (south of 35°N to about 3°N) surface concentrations of nitrate are generally below 1 μg-at/liter and frequently below the level of detection. In the Costa Rica Dome and equatorial upwelling regions, surface nitrate levels run as high as 8 to 10 μg-at/liter and reach levels of 20 to 25 μg-at/liter in the upper 100 meters.

METEOROLOGY

The meteorological parameters of greatest significance to OFEF, probably are wind velocity and duration. Severe storms with high velocity winds cause high waves and increased current speeds, which in turn can create increased stresses on substrate structures and kelp plants. Because wave heights and periods are related to wind speed, wind and storm characteristics are considered in this section. The ocean, as a liquid medium, is greatly influenced by severe storms, and siting of an OFEF in an area of minimal storm activity is more than likely important for its economic success and survival. It is probable that future technology will allow placement of the farm in areas of high-storm frequency but the resulting higher costs may dictate selection of areas of low-storm frequency and severity.

Tropical and Extratropical Cyclones

Tropical cyclones develop in the vicinity of 15° to 20°N and near 20°S latitude. In the northern hemisphere, tropical storms and hurricanes evolve from tropical cyclones which have grown from low level disturbances originating in the intertropical convergence zone (ICZ), an area where northeast and southwest trade winds meet (5° to 10°N). Figure 26 gives the average number of cyclones per 5-degree square per year, and the principal season for storm activity is also given for each region. Large areas off the east coast of the United States and the east coast of Asia, Australia, India, and Madagascar are characterized by relatively frequent tropical cyclones. Off the east coast of the U.S. there is at least one tropical cyclone per year per 5-degree square as far north as 42° (Fig. 26), due in part to the influence of the warm, northerly moving Gulf Stream. In the area of study (eastern Pacific), the region of cyclone frequency greater than or equal to one per year per 5-degree square only extends to 27°N because of the cooler California Current water moving south. The greatest frequency of cyclones, however, is in the eastern tropical Pacific, where it reaches a mean of six per year per 5-degree square in the vicinity of 16°N, 110°W (Fig. 26, Ref. 34). In the eastern Pacific, tropical cyclones generally occur in the period June through October, with the greatest frequency occurring during September.

The various stages of tropical cyclones, as well as other meteorological data, are given in Appendix D. Figure D.1 shows the areal distribution plus frequency and speed statistics for cyclonic winds of 18 m/sec (34 knot) or greater (gale-force winds) for 5-degree squares in the northeastern Pacific. During the 22-year period of record, there was only a single tropical cyclone in the vicinity of San Diego (4 percent probability of occurrence) whereas in the square 15° to 20°N and 105° to 110°W there were 106 such cyclones. The frequency and distribution of tropical storms (with winds of 25-32 m/sec or 48-63 knots) and hurricanes (winds $\geq$ 33 m/sec) are given in Figs. D.2 and D.3, respectively.

Figure 27 shows the maximum extent and mean tracks of both tropical and extratropical cyclones for the northeastern Pacific. Most tropical cyclones originating southwest of the area of maximal cyclone frequency (indicated by crosshatched line) move west-northwestward and reach as far as 180°. The maximum northerly extent of tropical storms with winds of 18 m/sec or greater is approximately 35°N. Hurricane-force storms (winds $\geq$ 33 m/sec, in the period of record) have not extended beyond 30°N (322 kilometers south of San Diego) and have reached the southern portion of the Hawaiian Islands (Fig. 27).

During autumn and early winter the cooling of the Asiatic continent and adjacent seas strengthens the surface temperature gradients and the polar front. This cooling trend and an intensification of the jet stream aloft leads to more frequent formation and greater development of extratropical cyclones.

The usual extratropical cyclone track is east to southeast (Fig. 27). The Gulf of Alaska is frequented by more extratropical cyclones than any other region of the north Pacific. Their maximum frequency and intensity is attained during early and middle winter. Off the west coast there are fewer than one extratropical cyclone per 5-degree square (during February) south of approximately 44°N. The intensity of extratropical cyclones

decreases in a southerly direction. The maximum southerly range of extratropical cyclones (with winds of ≥ 18 m/sec) is about 31°N.

Winds

Tropical and extratropical cyclone intensities are reflected in surface-wind velocities. In the northern portion of the survey area maximal surface winds occur in November and December and generally blow from the southwest. Figures D.4 through D.7 give wind data for the northern portion of the survey area and show percent frequency of wind speed and direction for 5-degree squares for four months representative of seasonal wind characteristics; January, April, July, and November, respectively. During November and December in the area between 40° and 50°N the frequency of gale-force winds (≥ 14 m/sec) can be as high as 30 to 35 percent. Figure 28 shows the percent of surface winds of Beaufort force ≤3 (5 m/sec) and ≥8 (17 m/sec) in the northern portion of the survey area.

For November there is a broad region of maximum frequency of strong winds where greater than 5 percent of the time winds of ≥18 m/sec were observed north of approximately 40°N. These frequencies decrease to the south. Conversely, light winds (≤5 m/sec) are most frequent nearshore with decreasing percentage frequencies to the north and west. The area of maximum frequency of light winds and minimum frequency of gale-force winds is off southern California and northern Baja California (30°-35°N), where light winds prevail 50-60 percent of the time (Fig. 28). Light winds also prevail along the coast of Canada throughout most of the year.

Mid- and late-winter bring a gradual reduction in mean surface wind speed and cyclone frequency. By February, average wind speeds are generally lower (9-10 m/sec) in the northern and central portion of Fig. 28. There is a general decline in average speeds toward the annual minimum in July or August. Minimum average speeds in most of the quadrangles vary between 4.9 and 6 m/sec during the summer months, with some increase occurring in the southeast section, south of 40°N. The reversal of climatic trends initiated over the northern part of the area during the latter part of August spreads rapidly and causes a marked increase of wind speeds and frequency of gales to nearly all of the area except the southeast corner.

In the southern portion of the survey area, wind speeds are generally less than those in the northern portion. The trade winds derived from the north and south Pacific subtropical high-pressure centers are the predominant factor in the area 30°N to the equator. Figures D.8 to D.11 give the percent frequency of wind speed and direction for the southern portion of the survey area. The trades are exceptionally steady winds, come from the northeast in all seasons, and overlie the region extending from 30°N to the intertropical convergence zone (ICZ) at approximately 10°N. Mean trade wind speed is nearly 8 m/sec. South of this region, the southeast trade winds predominate, intersecting with the northeast trades at the ICZ. Figure 29 gives the percent frequency of winds Beaufort force ≤3 (5 m/sec) and ≥8 (18 m/sec) for February and August.

In the coastal areas north of 10°N, intrusions of air from the Caribbean and the Gulf of Mexico are common. The more than 1 percent frequency of gales (Beaufort force 8) off

southern Mexico and Guatemala in February are caused by northerly winds from the Caribbean. There are large regions in the southeastern portion of the area where there is greater than 80 percent frequency of winds equal to or less than 5 m/sec. This and other areas where there are a high percentage of light winds are generally out of the major influence of the trade winds. In the areas where trade winds are strong, light winds usually represent only 10 to 30 percent of the total. Although high velocity winds are not common to most of the area, hurricane-force winds ($\geqslant$ 33 m/sec) caused by strong tropical cyclones have been reported as far north as 30°N (once in 6 years) and more frequently south of Baja California in the vicinity of 20°N, 115°W (12 times in six years) and to the west towards Hawaii (Figures C.5 through C.8). Wind velocities in these areas in excess of 50 m/sec have been reported (62 m/sec winds were measured in Hurricane Maggie, 480 kilometers south of Baja California in 1974, Ref. 44). Strong local winds are frequent during the winter in the Gulf of Tehuantepec and along the Central American coast (17°N to 8°N). These winds reach gale strength during periods of high pressure over the Caribbean and Gulf of Mexico. Local nearshore gale-force winds associated with violent thunderstorms are relatively common along the west coast of Mexico and Central America during the summer months.

Figure 30 gives a summary of environmental data for the central northeast Pacific, including percent frequency of wind velocity $\geqslant$ 17 m/sec for two Ocean Weather Stations (OWS N, 30°N, 140°W, and OWS P, 50°N, 145°W) and four quadrangles in between. The value of the OWS data is that the weather observation ships were continuously manned by professional observers for over twenty years (including periods of severe weather). Other data sources are usually from ships of opportunity and have a fair weather bias because most ships tend to avoid bad weather (Ref. 27). It is apparent from Fig. 30 that there is a marked reduction in frequency of gale-force winds from OWS P south to OWS N. At OWS P gale-force winds occur more than 10 percent of the time during January through March and October through December. The peak months are November and December where gale-force winds blow over 20 percent of the time. At OWS N, winds of greater than 17 m/sec occur near 1 percent of the time in January, February, and December and occur rarely, if ever, between June and September. Areas 1 through 4 show intermediate frequency structures. Figures 31 and 32 are monthly persistence graphs of gale-force winds for OWS N and P. These graphs depict the cumulative percent frequency of hours of duration of the event (winds $\geqslant$ 17 m/sec) equal to or less than the number of hours intersected by the solid curve; and also depict days interval between events equal to or less than the number of days intersected by the broken curve.

At OWS N winds of 17 m/sec or greater are of short duration, and there is generally a long period of time between the events. There are very few winds of high velocity during May and October. At OWS P, winds of 17 m/sec or greater are not uncommon during any month; the longest duration of event and shortest period between events occurs January through April and September through December (Fig. 32). Persistence graphs of low-velocity winds ($\geqslant$2.5 m/sec) will give an estimate of total wind energy available if wind powered energy sources are considered for upwelling apparatus. Figures 33 and 34 present persistence graphs for winds $\geqslant$2.5 m/sec for OWS N and P, respectively.

In summary, the most severe persistent winds are in the northern portion of the survey area and frequently are associated with extratropical storms in the fall and winter.

High-wind velocities are not uncommon north of 35°N but decrease significantly in frequency in southern California waters. The southern region of the area has steady, predominate trade winds averaging 5 to 10 m/sec, blowing from the northeast in latitudes 5° to 25°N and from the southeast 10°S to 5°N. Occasional high-velocity winds associated with local activity or tropical cyclones are observed along the coasts of Central America and Mexico. Other areas, particularly the northern Baja and southern California coast at latitudes 20° to 35°N, have very low-velocity winds (only rarely do they increase above 17 m/sec).

Wind-Generated Ocean Waves

Ocean waves are considered here as part of the meteorological data because nearly all near-surface waves are wind-generated and are directly related to wind velocity and duration. An exception would be the extremely rare tidal waves (tsunamis) generated by seismic disturbances or volcanic eruptions. Quantitative values for wave height (the vertical distance between a wave crest and the preceding trough) and period (length of time between successive crests) have been established as a function of wind speed, fetch (distance which the wind has blown over water), duration of the wind, and decay distance (distance the waves have progressed from the area of generation). Although ocean waves are generated as a direct result of wind action, other variables such as currents, bottom topography, and local winds affect their magnitude and direction.

Wave data are generally observed as either "sea" (waves generated by local winds) or "swell" (waves which travel beyond their source regions). The observed wave height is usually termed the "significant height" and is defined as the average value of the highest one third of all waves observed in a given wave train. "Extreme waves" are quite rare and occur when two or more very high waves come together in constructive phase. Extreme wave heights are discussed in the Extreme Meteorological Data Section and are defined by Thom (Ref. 37):

$$\text{Extreme Wave Height} = 1.8 \times \text{Significant Wave Height.}$$

Figure 35 gives an empirically-derived curve of sustained wind speed versus significant wave height for increasing and decreasing wind regimes. The figure indicates that for decreasing winds the significant wave height will generally be higher because of the longer period of time that the wind has blown. The right side of Fig. 35 thus demonstrates a "fully arisen" sea (the total energy possible from a wind has been translated to wave energy). This figure can be used to derive approximate values of significant wave heights from the wind data given in the previous section.

Wave period is highly important as an engineering consideration because it controls the depths reached by given fractions of the wave motion (amplitude and velocity). Figure 36 shows the attenuation of wave motion with depth given the period of the wave. For example, the motion of a wave with a 6-second period is 50 percent attenuated at about 4.5 meters of depth and becomes insignificant (4 percent of surface wave energy remaining) at 26 meters, while a 12-second wave is 50 percent attenuated at 23 meters and becomes insignificant at 110 meters. (Note: Wave-induced drag forces scale with the square of the wave motion.)

Figures 37 to 40 give percent frequency of wave height, period, and wave direction for winter (Jan-Mar), spring (Apr-Jun), summer (Jul-Sep), and fall (Oct-Dec), respectively, for the northern sector (30° to 45°N) of the survey area. During the winter months the frequency of high seas (≥3.7 meters) increases from south to north and from east to west, showing a maximum of 15 percent in the northwest and a minimum of about 2 percent off southern California. The prevailing southwest to west winds, reflecting the steep pressure gradient between the Aleutian low and the north Pacific high, generate high frequencies (>50 percent) of seas 1.5 meters or higher in the west. These decrease substantially towards the east.

During May, seas of 1.5 meters or higher are at a maximum frequency (near 50 percent) at 30° to 35°N and 120° to 130°W. The summer months represent the period of lowest sea state for the entire area. However, the winter trend is reversed; the wave heights tend to increase slightly toward the east with the area of maximum frequency of 1.5 meters or greater seas being located about 35° to 40°N and 125° to 130°W. Waves of 3.7 meters or higher are observed with frequencies of 2 percent or less in all areas. During the fall, the sea state begins to increase toward winter values.

Wave heights of at least 1 meter will probably be necessary for wave-powered pumps of economical size. Figures 41 and 42 give persistence graphs for wave heights of 1 meter or greater at OWS N and P, respectively (see Fig. 30 for map). They give percent frequencies of the duration of events and days interval between events. At both weather stations there is a maximum of approximately 5 days between events (100 percent of the waves ≥1 meter were followed by another such condition within 5 days).

The median duration of waves ≥1 meter is about 50 hours in the summer and over 200 hours in the winter at OWS N, and 24 hours both summer and winter for OWS P. Figures 43 and 44 give persistence graphs for high seas (≥5 meters) for OWS N and P, respectively. At OWS N waves ≥5 meters are rare or nonexistent during May through September. The rare occurrence in August is probably due to occasional tropical cyclones. During fall and winter the median duration of high seas is between 6 and 12 hours and the median interval is between 8 and 16 days. For OWS P, high seas are more frequent, with the median duration being similar (6-12 hours), but the median interval is reduced to 1 to 2 days in winter or fall and 40 to 48 days in summer (June, July).

In the southern portion of the survey area sea and swell are caused by the northeast trade winds. During winter and fall these winds blow from 5° to 25°N and during spring and summer they blow from 10° to 30°N. Southeast trades are important in producing sea and swell in the southeast section during spring and summer.

The frequency of seas greater than or equal to 1.5 meters in height is generally greater in the western portion of the survey area because of the long northeast fetch. Figures 45 and 46 give the percent frequency of wave height, period, and direction characteristics for winter and summer for the southern portion of the survey area from 30°N to 0°. During the winter and spring, seas are normally from the northeast. South of 5°N the seas are generally from the southeast to east because of the southeast trades. The seas become calmer as the coast is approached, with the southeast being the calmest portion due to the short

northeast fetch; about 10 percent of the waves are ≥1.5 meters as compared to 60 percent in the northwest corner (Fig. 45). High seas, 3.7 meters or greater, occur less frequently in the southwest than throughout most of the northern section. They occur generally less than 2 percent of the time but approach 10 percent in two quadrats (10° to 20°N, 120° to 130°W and 20° to 30°N, 130° to 140°W). Summer gives the most northerly advance of the southeast trades, to 10°N. Frequency of 1.5-meter or greater seas varies from a maximum of about 45 percent in the northwest to a minimum of 15 percent in the southeast. Seas of 3.7 meters are rare in the 20° to 30°N region but are slightly more common in the 10° to 20°N region due to the tropical cyclones (Fig. 46) which occasionally occur in that region.

In summary, sea states are generally higher at points further from the coast (west) and at the higher latitudes (north). Fall and winter show the highest seas, and summer is the calmest season except for occasional tropical cyclones through the southeastern section.

Summary of Meteorological Data

Wind and wave data for the survey area were requested from the Naval Weather Service Detachment, National Climatic Center, Asheville, North Carolina. Table 4 is a summary of these data and presents monthly mean and 99.5 percentile wind speeds and wave heights, the percentile of 18 m/sec winds, and an annual wave period distribution. Events of 99.5 percentile indicate that 0.5 percent of the time (3.5 hours/month), during any given month, the event will occur at or greater than the level indicated. The areas of the meteorological survey are shown in Fig. 47. The areas delineated are equivalent to those oceanographic survey quadrats in Fig. 1 as indicated by the number in the lower right hand corner of each area. Areas 5 and 6 have the lowest mean wind velocities (3 to 5 m/sec in winter and 4 to 6 m/sec in summer) and have maximum wind velocities during summer of 19 and 14 m/sec, respectively. Area 5 is subject to tropical cyclones during late summer and early fall, which explains the elevated summer velocities. Area 4 has the highest mean (6-8 m/sec) and 99.5 percentile (19-26 m/sec) wind velocities. This represents the area north of Point Conception to 45°N. The high winter maximums (23-26 m/sec) represent the southerly extension of extratropical cyclones. Areas 1, 2, and 3 are similar, averaging between 5 and 8 m/sec winds with maximum winds (99.5 percent) varying between 13 and 18 m/sec. These winds are relatively constant because they are in the northeast trade wind zone.

Mean wave heights are rather constant in all the areas surveyed varying between 1 and 1.5 meters. Maximum waves vary significantly; the highest seas are in the north (area 4, varying between 4.5 meters in the summer and 8 meters in January) and in the west (4 to 7.5 meters), due to the long fetch of the northeast trades. All the other areas have lower maximum sea states which vary between 3 and 5 meters at the 99.5-percent level.

Table 4. Summary of mean and 99.5 percentile wind and wave data for the eastern Pacific.
(1 knot≈ 0.5 m/sec)

(Data from the Naval Weather Service, Environmental Detachment, National Climatic Center, Asheville, NC)

NOTES

1. Values of the mean and 99.5 percentile of wind speed (knots) and wave height (meters) are presented for all months. Wave height is the greater of sea and swell when both are reported. Otherwise it is the reported value of sea or swell. A distribution of the annual percent frequency of wave period (seconds) by specified groups is also provided.

2. Observations in TDF-11 are primarily from ships-in-passage. These ships tend to avoid areas of known "heavy weather" (i.e., strong winds and high seas). Radio communications and optimum track ship routing have produced a "fair weather bias" (i.e., a decrease in the frequency of heavy weather observations) in this data file.

Area 1; 15-20°N, 145-155°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	13	14	14	13	13	13	14	14	13	12	14	15
99.5 percentile	35	35	31	31	28	27	27	28	26	29	35	35
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1	1.5	1.5
99.5 percentile	7.5	6	5.5	4.5	4.5	4	4	3.5	3.5	4.5	5.5	6.5

Wave period distribution (annual):
(<6 sec) 42%, (6-7 sec) 30%, (8-9 sec) 15%, (10-11 sec) 6%

Area 2; 3-13°N, 120-140°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	12	12	11	12	10	10	10	11	11	10	11	12
99.5 percentile	28	29	30	30	25	24	24	25	26	25	24	27
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1	1	1	1.5	1.5	1.5	1	1.5
99.5 percentile	4	5	5	4	4.5	3.5	3.5	4	4	3.5	3.5	4

Wave period distribution (annual):
(<6 sec) 47%, (6-7 sec) 25%, (8-9 sec) 10%, (10-11 sec) 5%

Table 4. (Continued).

Area 3; 23-30°N, 120-130°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	12	12	12	13	13	12	12	11	11	11	10	12
99.5 percentile	30	30	30	30	27	26	28	28	28	25	30	28
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1	1	1	1.5	1.5	1.5	1.5	1	1	1	1.5	
99.5 percentile	4	4.5	4.5	5	4.5	4.5	4.5	4.5	4	4	5	

Wave period distribution (annual):
(<6 sec) 38%, (6-7 sec) 29%, (8-9) 19%, (10-11 sec) 8%

Area 4; 35-45°N, 121-132°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	16	16	15	15	13	13	12	12	12	13	14	15
99.5 percentile	50	45	45	43	40	40	38	36	37	40	44	50
Wind speeds of 34 knots were in the 97 percentile.												
mean wave height (m)	1.5	1.5	1.5	1.5	1.5	1.5	1	1	1	1	1.5	1.5
99.5 percentile	8	7	6.5	6.5	6	5	5	4.5	5	6	6.5	8

Wave period distribution (annual):
(<6 sec) 33%, (6-7 sec) 28%, (8-9 sec) 20%, (10-11 sec) 8%

Area 5, 10-15°N, 100-110°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	8	8	7	7	7	9	8	8	9	8	7	7
99.5 percentile	24	25	21	21	27	35	33	30	37	30	30	27
Wind speeds of 34 knots were in the 99.7 percentile.												
mean wave height (m)	1	1	1	1	1	1	1	1	1.5	1	1	1
99.5 percentile	3	4	4	3.5	4	4.5	4	4	4.5	4	4	4.5

Wave period distribution (annual):
(<6 sec) 52%, (6-7 sec) 18%, (8-9 sec) 8%, (10-11 sec) 4%

Table 4. (Continued).

Area 6, 2°S to 3°N, 95-110°W.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
mean wind speed (kts)	8	8	7	7	8	10	11	11	10	9	9	9
99.5 percentile	24	24	24	24	24	25	27	27	25	24	24	24
Wind speeds of 34 knots were in the 99.9 percentile.												
mean wave height (m)	1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1
99.5 percentile	3.5	4	4	4	4	5	4.5	4.5	5	4	4	3.5

Wave period distribution (annual):
(<6 sec) 49%, (6-7 sec) 24%, (8-9 sec) 9%, (10-11 sec) 4%

Extreme Meteorological Data

Extreme wind and wave data are highly important to the design and siting of the OFEF. These data need to be assessed in relation to engineering and biological requirements and tolerances. Table 5 gives the extreme wind speed, significant wave heights, and extreme wave heights, for specified return periods for west coast, Hawaii, and east coast areas (the latter is included for informational comparison purposes). Figure 48 shows coastal areas where wind and wave recurrence statistics were computed. The table gives mean return period, which is defined as the average number of years between successive occurrence of values greater than, or equal to, the stated value. On the west coast from central California to Washington, areas 25 to 30 have the highest extreme winds; these areas have 25-year wind returns value of 41 to 43 m/sec (Ref. 38). The area off Hawaii has 37- to 40-m/sec 25-year extreme winds. The coastal areas of lowest extreme velocities are southern California (area 22) and northern Baja California (Area 20), showing 31 and 35 m/sec, respectively for 25-year extremes. Off southern California, the five-year return extreme is by far the lowest at 26 m/sec.

Wave-height extremes show a similar trend to the wind values with the highest waves off northern California, Oregon, and Washington. The 25-year significant wave for this area varies between 15 and 16 meters (extreme waves of 27 to 29 meters), whereas off southern California the significant 25-year wave is between 11 and 12 meters (extremes of 19 to 21 meters).

Waves in the Hawaiian waters are estimated at 15 to 16 meters, significant height and 23 to 28 meters for extreme waves for 25-year return periods.

Tables 6 and 7 give high-wind and wave-recurrence statistics for the northwestern portion of the survey area. The highest winds occur in the northern portion at OWS P (50°N) where the 5-year wind is 43 m/sec and the 25-year wind is 51 m/sec. The minimum extreme winds are observed at OWS N (30°N) where the 5- and 25-year winds are 32 and 39 m/sec, respectively. Areas 1 to 4 have intermediate extreme winds.

Table 5. Extreme wind speed, significant wave height and extreme wave heights for specified return periods for the West Coast, Hawaii and the east coast of the U.S. Survey areas are shown in Fig. 48. (1 foot = 0.3 meter)

(Data from NOAA, Ref. 38)

Extreme wind speed for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	76	83	92	100	109	27	66	72	80	87	94
2	68	78	93	108	125	28	68	73	82	89	96
3	56	61	70	78	88	29	67	73	82	88	96
4	71	77	86	94	103	30	67	73	81	88	95
5	67	74	83	91	100	31	59	65	72	78	85
6	63	70	78	86	96	32	73	79	88	95	104
7	66	73	83	91	102	33	71	77	86	93	101
8	68	76	90	104	120	34	70	76	85	92	100
9	71	79	92	105	120	35	71	77	86	93	101
10	72	81	96	110	128	36	75	82	91	99	107
11	69	79	94	109	126	37	69	75	84	91	98
12	63	73	88	102	118	38	77	83	93	101	109
13	62	72	88	102	119	39	73	80	89	96	104
14	62	73	89	103	120	40	73	79	88	96	104
15	63	73	88	102	118	41	74	80	89	97	105
16	63	72	86	100	116	42	75	81	91	98	107
17	62	70	84	96	111	43	76	83	92	100	108
18	60	68	79	91	104	44	77	84	93	101	110
19	62	69	79	89	100	45	76	83	92	100	108
20	56	61	69	75	81	46	74	81	90	97	106
21	60	66	73	79	86	47	67	73	81	88	95
22	50	55	61	66	72	48	63	68	76	82	89
23	64	70	78	84	91	49	54	59	65	71	77
24	56	60	67	73	79	50	61	67	75	82	90
25	65	71	79	86	93	51	59	65	72	79	87
26	68	74	83	90	97	52	64	69	78	85	93

--Significant wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	44	50	59	66	74
2	37	42	49	56	62
3	31	36	42	47	53
4	37	42	50	56	63
5	35	40	47	53	59
6	36	41	48	54	61
7	38	43	50	56	63
8	47	53	63	70	79
9	50	57	67	75	84
10	44	50	59	66	74
11	41	47	55	61	69
12	38	43	50	56	63
13	36	41	48	54	61
14	33	37	43	49	55
15	34	38	45	51	57
16	34	39	46	51	58
17	34	39	45	51	57
18	33	38	44	50	56
19	32	36	43	48	54
20	32	36	43	48	54
21	30	34	39	44	50
22	28	32	38	42	48
23	26	30	35	39	44
24	32	36	42	47	53
25	38	43	50	56	63
26	39	45	52	59	66
27	38	43	50	57	64
28	39	44	52	58	65
29	39	44	52	58	65
30	39	44	51	58	65
31	34	39	45	51	57
32	39	44	51	58	65
33	38	43	51	57	64
34	38	43	50	56	63
35	38	43	51	57	64
36	38	43	51	57	64
37	36	40	47	53	60
38	41	46	54	61	68
39	38	44	51	57	64
40	38	43	51	57	64
41	36	41	48	54	60
42	33	37	43	49	55
43	33	37	43	49	55
44	31	35	41	46	52
45	19	22	26	29	33
46	22	25	29	33	37
47	18	20	24	27	30
48	22	24	29	32	36
49	18	21	24	27	31
50	37	41	49	55	61
51	31	35	41	46	52
52	38	43	51	57	64

--Extreme wave height estimates (feet) for specified return periods.

Area	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
1	80	90	106	119	134
2	67	76	89	100	112
3	56	64	75	84	95
4	67	76	90	101	113
5	64	72	85	95	107
6	65	74	87	97	109
7	68	77	90	102	114
8	85	96	113	127	142
9	91	103	120	135	152
10	80	90	106	119	134
11	74	84	98	111	124
12	68	77	90	101	114
13	65	74	87	98	110
14	59	66	78	87	98
15	61	69	81	91	102
16	62	70	82	92	104
17	62	70	82	92	103
18	60	68	80	90	101
19	58	66	77	86	97
20	58	66	77	86	97
21	53	60	71	80	89
22	51	58	68	76	86
23	47	54	63	71	80
24	57	65	76	85	96
25	68	77	90	101	113
26	71	80	94	106	119
27	68	78	91	102	115
28	70	80	93	105	118
29	70	79	93	104	117
30	70	79	93	104	117
31	61	70	81	92	103
32	70	79	92	104	117
33	69	78	91	103	115
34	68	77	90	101	114
35	69	78	92	103	116
36	69	78	91	103	115
37	64	73	85	96	108
38	73	83	97	109	122
39	69	78	92	103	116
40	69	78	91	103	115
41	65	74	86	97	109
42	59	66	78	87	98
43	59	66	78	87	98
44	56	63	74	84	94
45	35	40	46	52	59
46	40	45	53	59	67
47	32	36	43	48	54
48	39	44	51	58	65
49	33	38	44	49	56
50	66	75	87	98	110
51	56	63	74	83	93
52	69	78	91	102	115

Table 6. Extreme wind velocity recurrence intervals for the north central Pacific.

(1 knot ≈ 0.5 m/sec)

(Data from Naval Weather Service, Ref. 27)

AREA 1

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	74
10	81
25	90
50	98
100	106

AREA 2

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	74
10	81
25	90
50	97
100	105

AREA 3

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	73
10	79
25	88
50	95
100	104

AREA 4

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	70
10	76
25	85
50	92
100	100

OWS N

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	62
10	67
25	75
50	81
100	88

OWS P

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SUSTAINED WIND (KNOTS)
5	83
10	90
25	100
50	109
100	118

LEGEND

HIGH WIND RECURRENCE INTERVALS

On the average the indicated threshold wind speeds will be equalled or exceeded at least once during a mean recurrence interval. Wind speeds are sustained values (i.e., averaged over a period of about a minute) and are estimated to represent a nominal height of about 10 meters above the surface.

AREA MAP

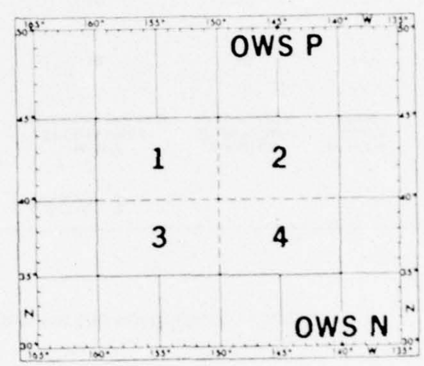


Table 7. Maximum significant and extreme wave height recurrence intervals for the north central Pacific.

(1 knot ≈ 0.5 m/sec)

(Data from Naval Weather Service, Ref. 27)

AREA 1

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	43	78
10	49	88
25	57	103
50	65	116
100	72	130

AREA 2

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	43	77
10	49	88
25	57	103
50	64	115
100	72	130

AREA 3

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	42	76
10	48	86
25	56	101
50	63	113
100	71	127

AREA 4

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	41	73
10	46	83
25	54	97
50	60	109
100	68	122

OWS N

MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	35	64
10	40	72
25	47	85
50	53	95
100	59	107

OWS P

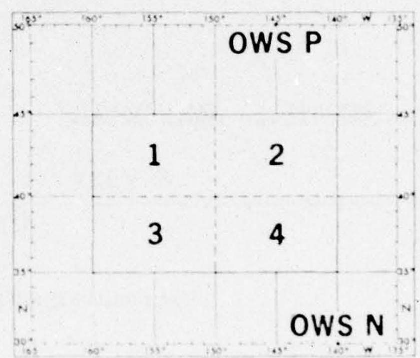
MEAN RECURRENCE INTERVAL (YEARS)	MAXIMUM SIGNIFICANT WAVE (FEET)	EXTREME WAVE (FEET)
5	48	87
10	55	98
25	64	115
50	72	130
100	81	146

LEGEND

HIGH WAVE RECURRENCE INTERVALS

On the average the indicated threshold wave heights will be equalled or exceeded at least once during a mean recurrence interval. Maximum significant waves represent the highest one-third of the waves (sea or swell). Extreme wave heights are estimated to be 1.8 times the significant wave height.

AREA MAP



Maximum significant and extreme wave heights are given in Table 7. The highest seas are at OWS P where the maximum significant wave heights for 5- and 25-year intervals are 15 and 20 meters and the extreme wave heights for the same periods are 27 and 35 meters. OWS N has the least severe seas in the northwest area with 11- to 14-meter maximum significant wave heights and 20- to 26-meter extreme wave heights for 5- and 25-year intervals. Again, because of the many years of data collected in bad as well as good weather, the Ocean Weather Station extreme data are probably the most accurate available for open ocean areas.

As a note of interest, probably the largest wave ever observed and accurately measured was in the general vicinity of the study area, at 34°N, 167°W. The wave was approximately 34 meters high and was geometrically measured by personnel aboard the USS RAMAPO, 7 February 1933 (Ref. 39).

Extreme current data are also very important to the Ocean Farm. Current measurements in severe weather are extremely rare, and generally only theoretical data exists. A brief discussion of this topic is given in Appendix E. A further discussion of extreme meteorological data is given in Refs. 40 through 44.

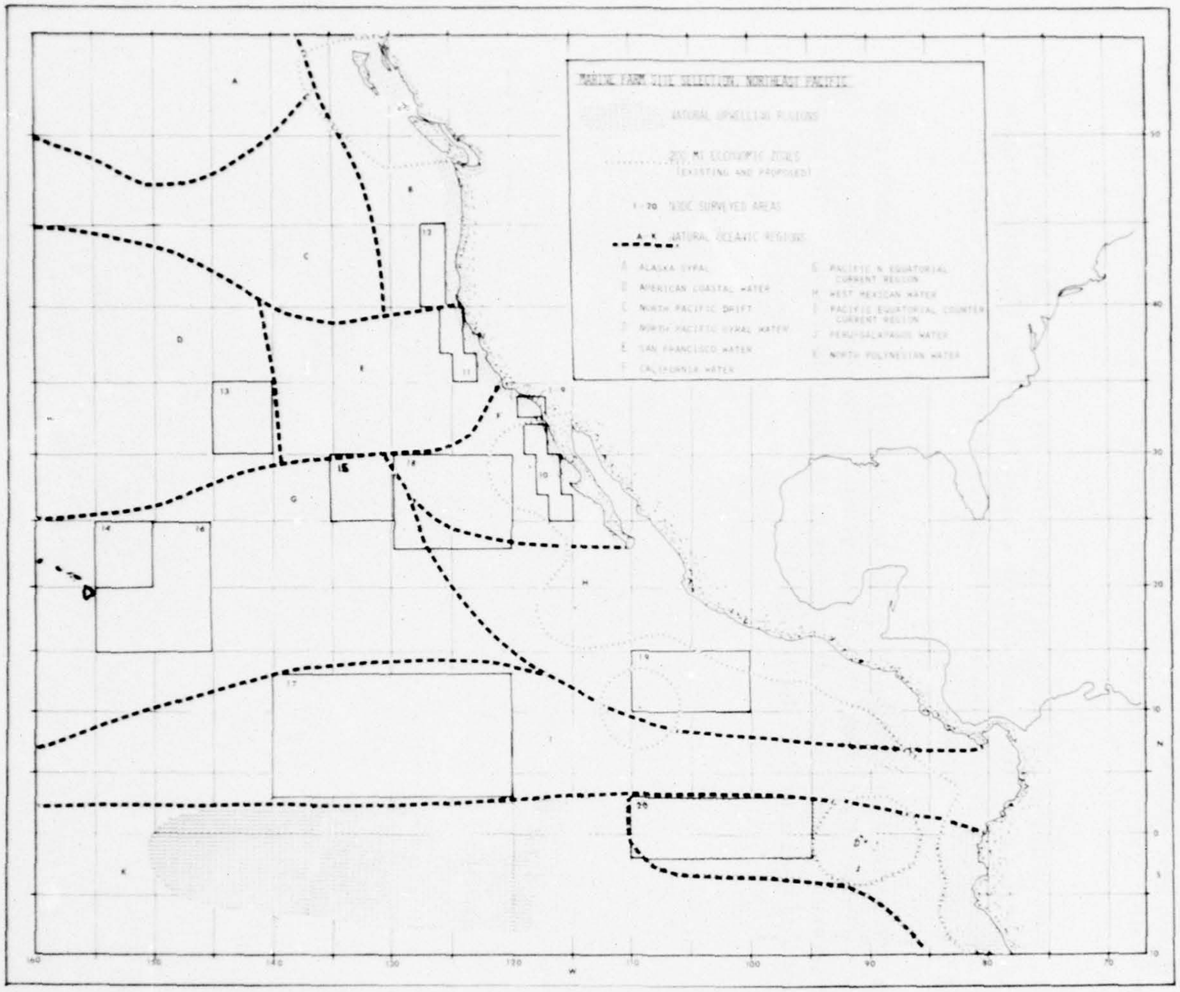


Figure 1. Eastern Pacific area chosen for oceanographic and meteorological survey for Phase 1 and future Ocean Farms. Natural Oceanic regions (Ref. 20) as delineated by Laevastu and LaFond, 1970 (Ref. 21) are given. Natural upwelling regions (EastroPac Atlases, Ref. 22; CALCOFI Atlas, Ref. 23, 24, 25) and existing or proposed economic or territorial zones are shown.

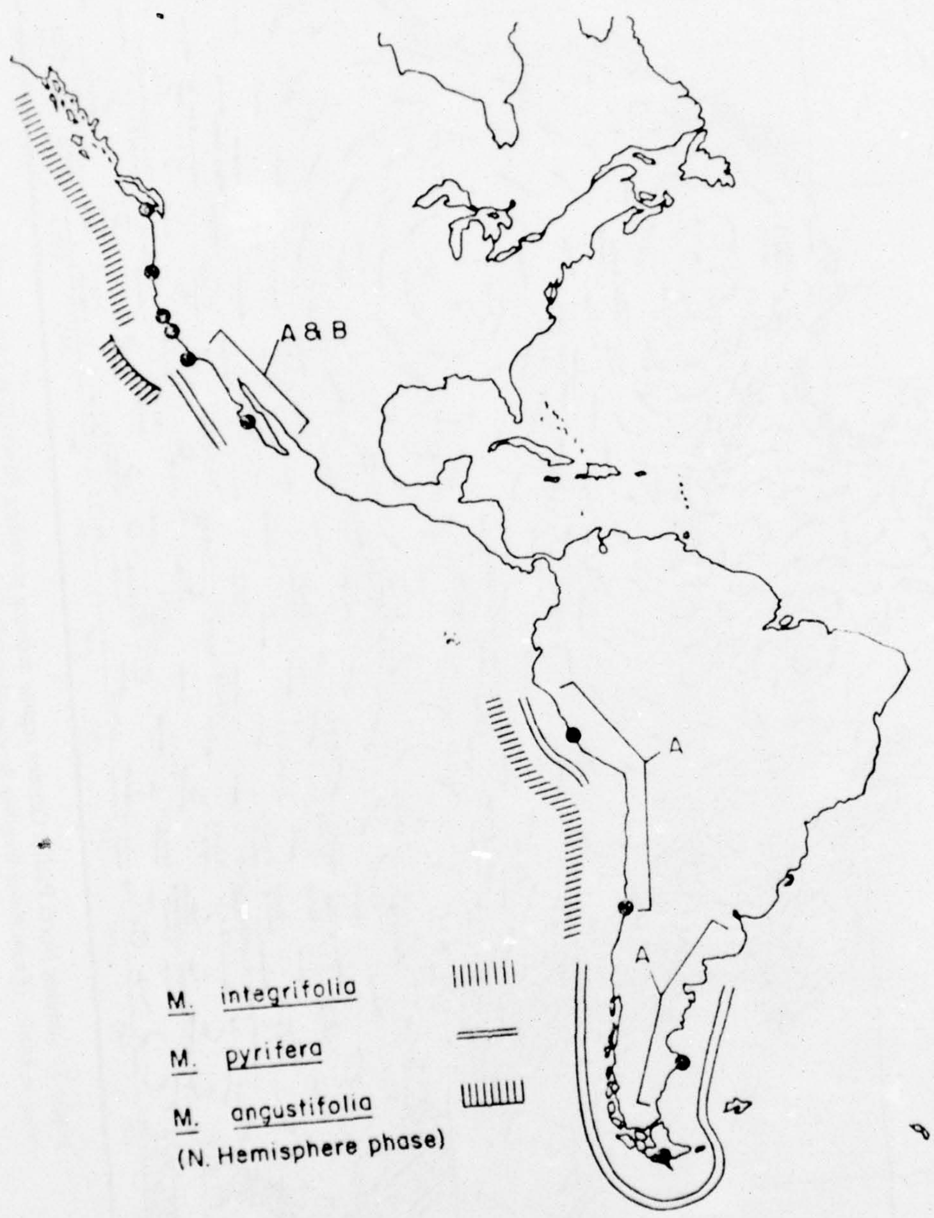


Figure 2. Distribution of Macrocystis in North and South America. A. Aerial observations of the coast. B. Detailed diving surveys; points where areas were examined intertidally or by diving are indicated. (From Neushul, 1971, Ref. 26) Note: M. pyrifera occurs as far north as the coast of Alaska but is not dominant north of about 35°N.

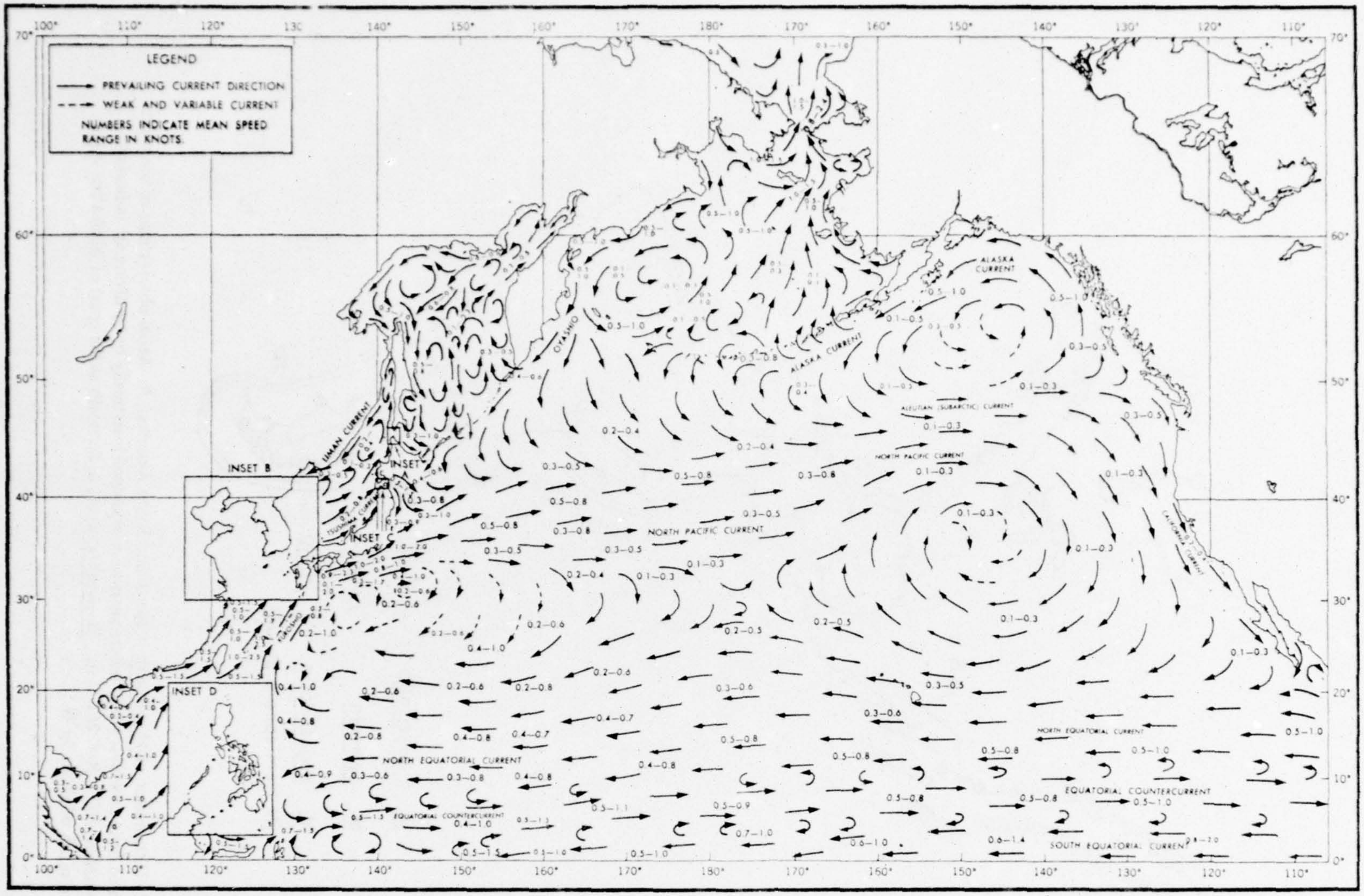


Figure 3. Summer North Pacific Current regime showing prevailing direction and mean speed range in knots. (From Naval Weather Service, Ref. 27) (1 knot ≈ 0.5 m/sec)

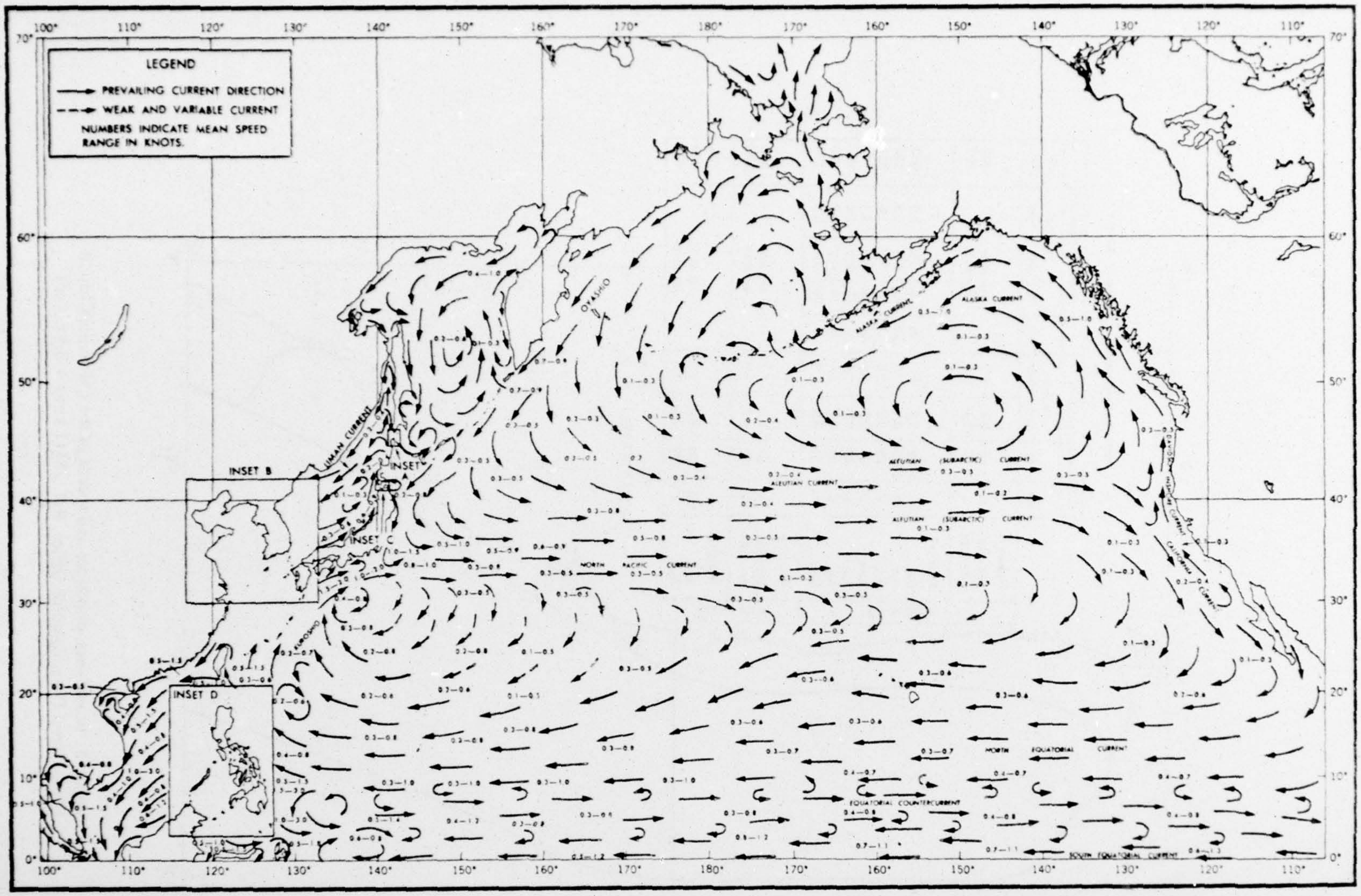
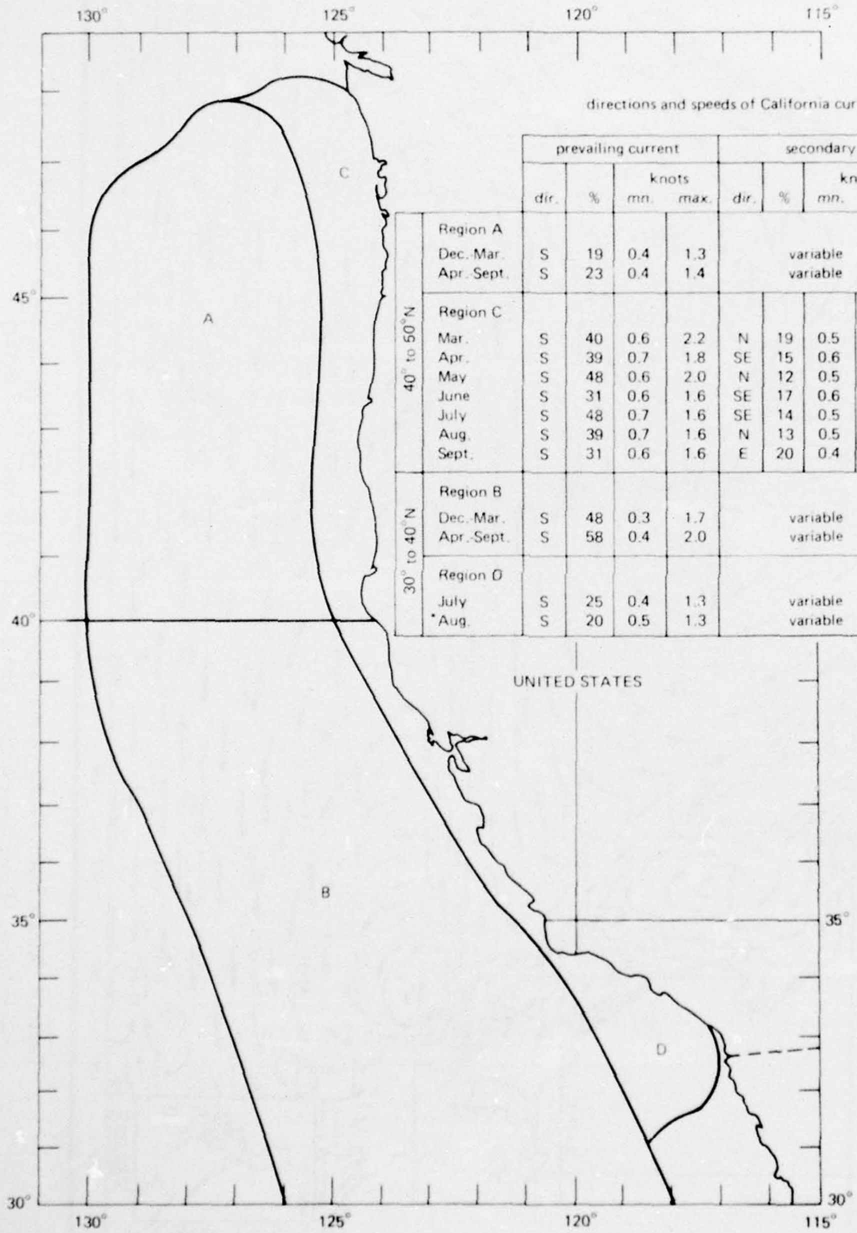


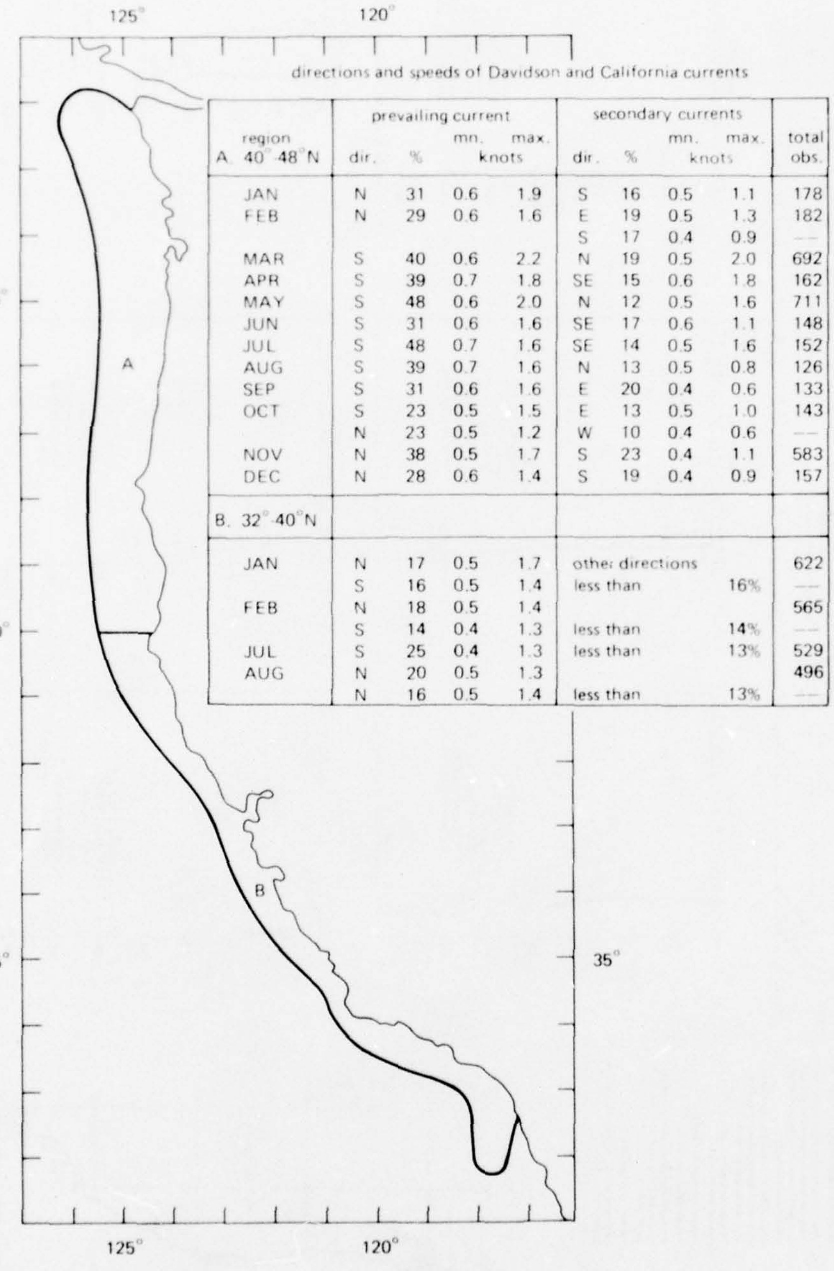
Figure 4. Winter North Pacific current regime showing prevailing direction and mean speed range in knots. (From Naval Weather Service, Ref. 27) (1 knot ≈ 0.5 m/sec)



directions and speeds of California current

		prevailing current				secondary current				
		dir.	%	knots mn.	knots max.	dir.	%	knots mn.	knots max.	total obs.
40° to 50° N	Region A									
	Dec.-Mar.	S	19	0.4	1.3	variable				426
	Apr.-Sept.	S	23	0.4	1.4	variable				864
	Region C									
	Mar.	S	40	0.6	2.2	N	19	0.5	2.0	692
	Apr.	S	39	0.7	1.8	SE	15	0.6	1.8	162
	May	S	48	0.6	2.0	N	12	0.5	1.6	711
	June	S	31	0.6	1.6	SE	17	0.6	1.1	148
	July	S	48	0.7	1.6	SE	14	0.5	1.6	152
	Aug.	S	39	0.7	1.6	N	13	0.5	0.8	126
	Sept.	S	31	0.6	1.6	E	20	0.4	0.6	133
30° to 40° N	Region B									
	Dec.-Mar.	S	48	0.3	1.7	variable				4,551
	Apr.-Sept.	S	58	0.4	2.0	variable				6,970
	Region D									
	July	S	25	0.4	1.3	variable				529
	Aug.	S	20	0.5	1.3	variable				496

Figure 5. Boundaries, directions and speeds of the California Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)



directions and speeds of Davidson and California currents

region	prevailing current				secondary currents				total
A. 40°-48°N	dir.	%	mn. knots	max. knots	dir.	%	mn. knots	max. knots	obs.
JAN	N	31	0.6	1.9	S	16	0.5	1.1	178
FEB	N	29	0.6	1.6	E	19	0.5	1.3	182
					S	17	0.4	0.9	—
MAR	S	40	0.6	2.2	N	19	0.5	2.0	692
APR	S	39	0.7	1.8	SE	15	0.6	1.8	162
MAY	S	48	0.6	2.0	N	12	0.5	1.6	711
JUN	S	31	0.6	1.6	SE	17	0.6	1.1	148
JUL	S	48	0.7	1.6	SE	14	0.5	1.6	152
AUG	S	39	0.7	1.6	N	13	0.5	0.8	126
SEP	S	31	0.6	1.6	E	20	0.4	0.6	133
OCT	S	23	0.5	1.5	E	13	0.5	1.0	143
	N	23	0.5	1.2	W	10	0.4	0.6	—
NOV	N	38	0.5	1.7	S	23	0.4	1.1	583
DEC	N	28	0.6	1.4	S	19	0.4	0.9	157
B. 32°-40°N									
JAN	N	17	0.5	1.7	other directions				622
	S	16	0.5	1.4	less than			16%	—
FEB	N	18	0.5	1.4					565
	S	14	0.4	1.3	less than			14%	—
JUL	S	25	0.4	1.3	less than			13%	529
AUG	N	20	0.5	1.3					496
	N	16	0.5	1.4	less than			13%	—

Figure 6. Boundaries, directions and speeds of the Davidson Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)

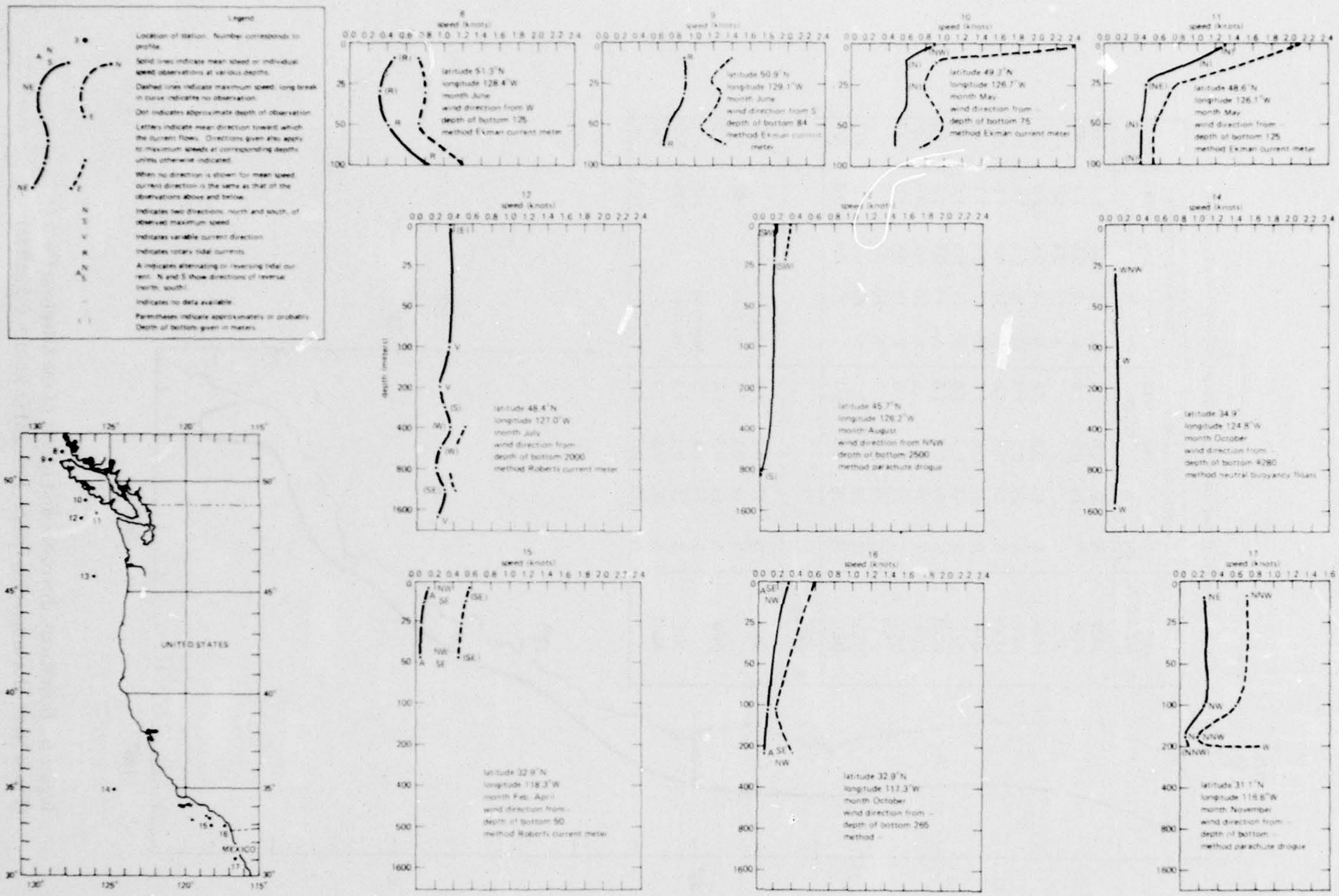


Figure 7. Current speed profiles for the northeastern Pacific area. (1 knot ≈ 0.5 m/sec) (From U.S. Navy sources)

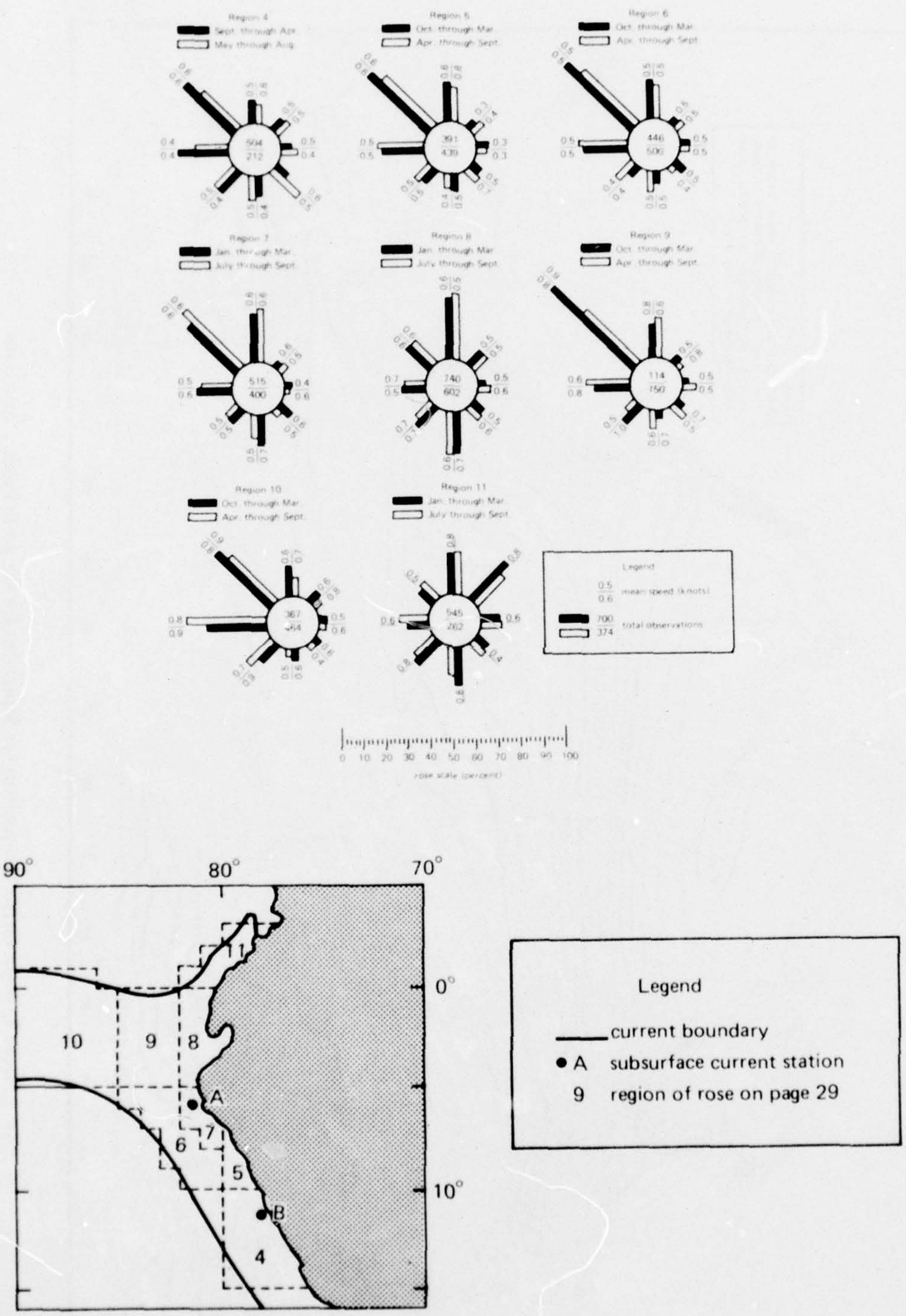


Figure 8. Boundary, direction and velocity of the northern portion of the Peru Current. (From Naval Oceanographic Office, Ref. 28) (1 knot ≈ 0.5 m/sec)

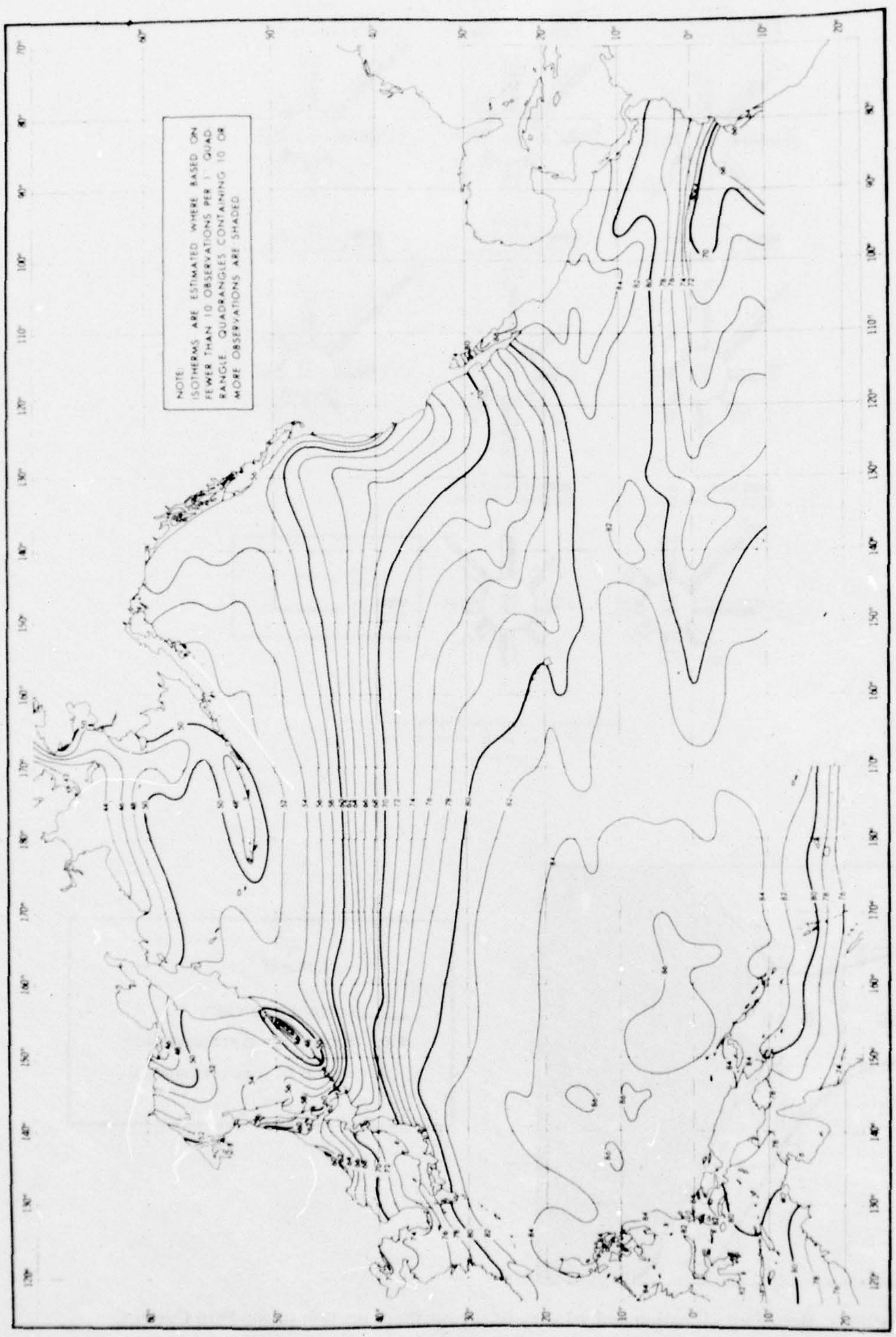


Figure 9. Mean surface temperature for September for the north Pacific. Isotherms in degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

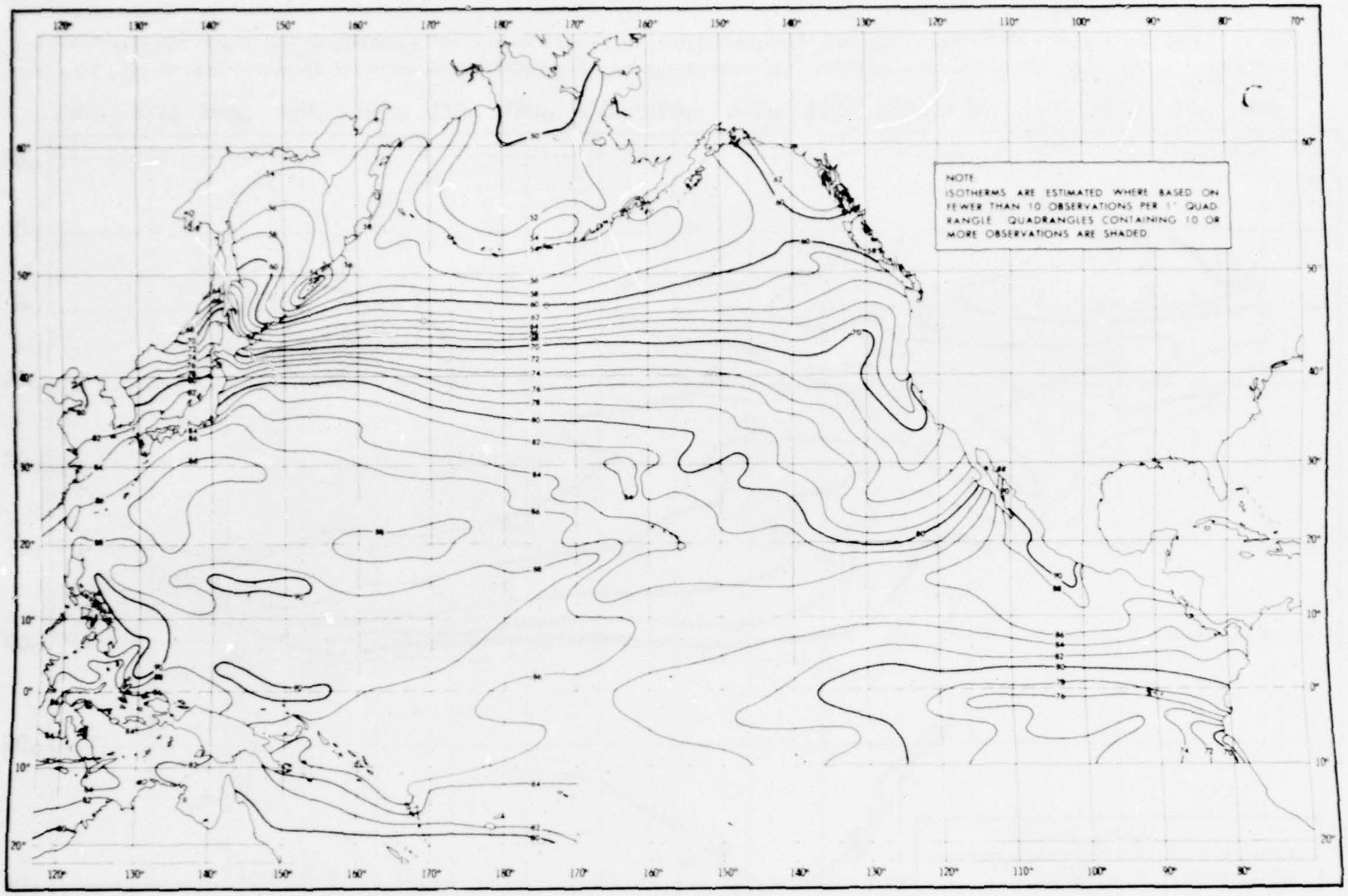


Figure 10. Maximum surface temperatures for September in the north Pacific. Isotherms in degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

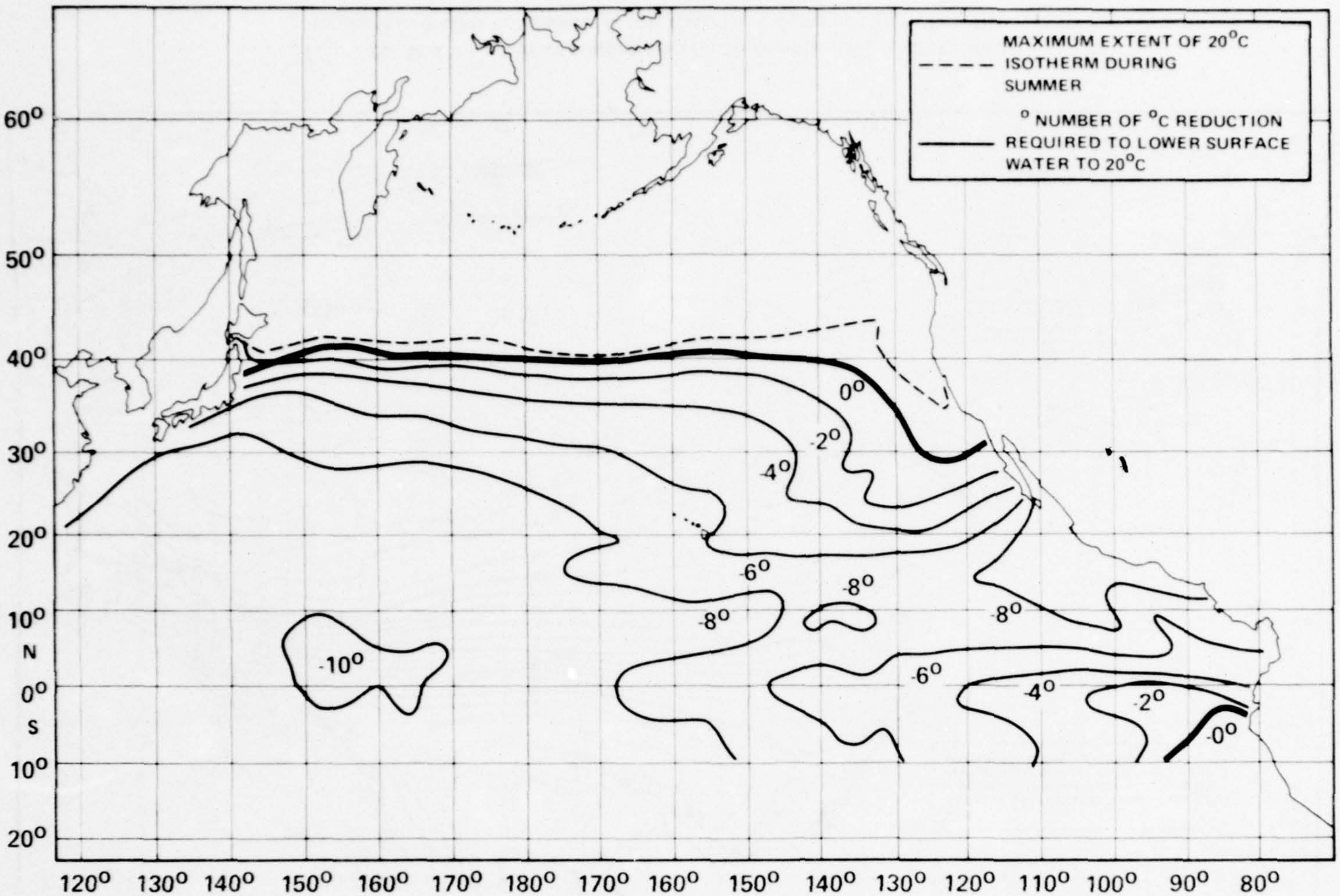


Figure 11. The amount of cooling of surface waters required to lower the mean ambient September temperature to 20°C. Heavy line indicates the northern extent of the 20°C isotherm (i.e., no cooling required). (Temperature data from Naval Oceanographic Office, Ref. 30)

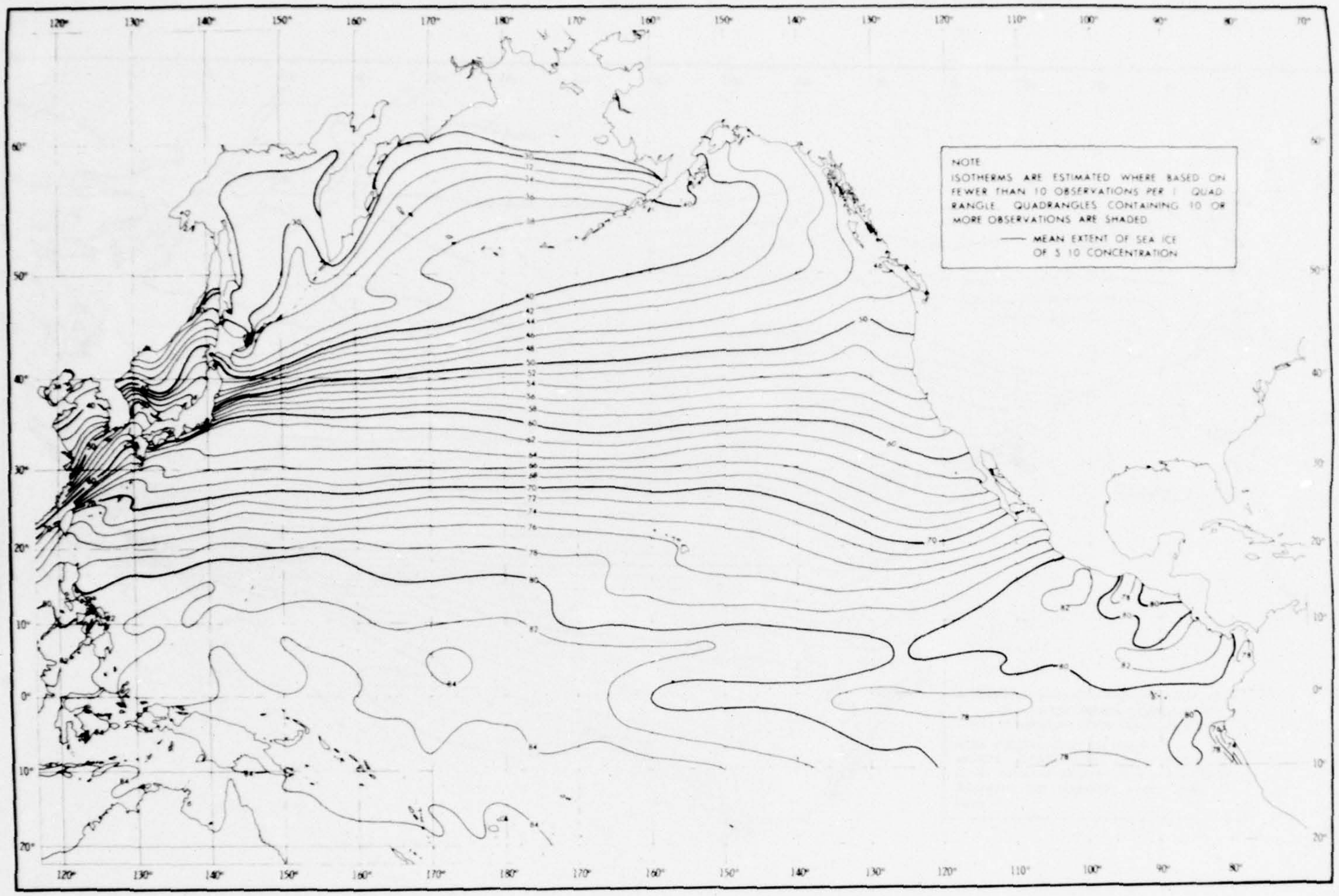


Figure 12. Mean surface temperature for the north Pacific for February. In degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

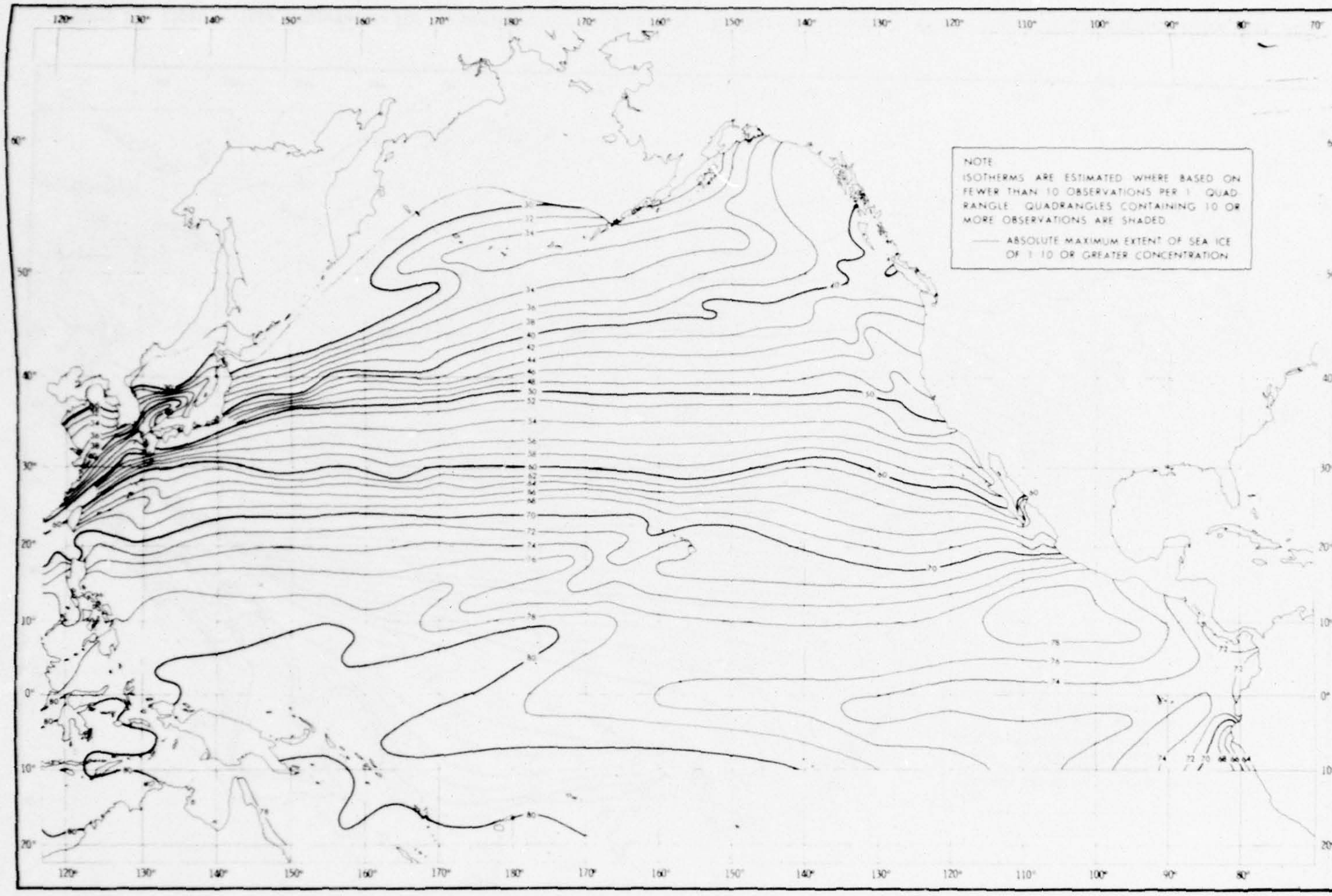


Figure 13. Minimum surface temperature for the north Pacific for February. In degrees Fahrenheit. (From Naval Oceanographic Office, Ref. 30)

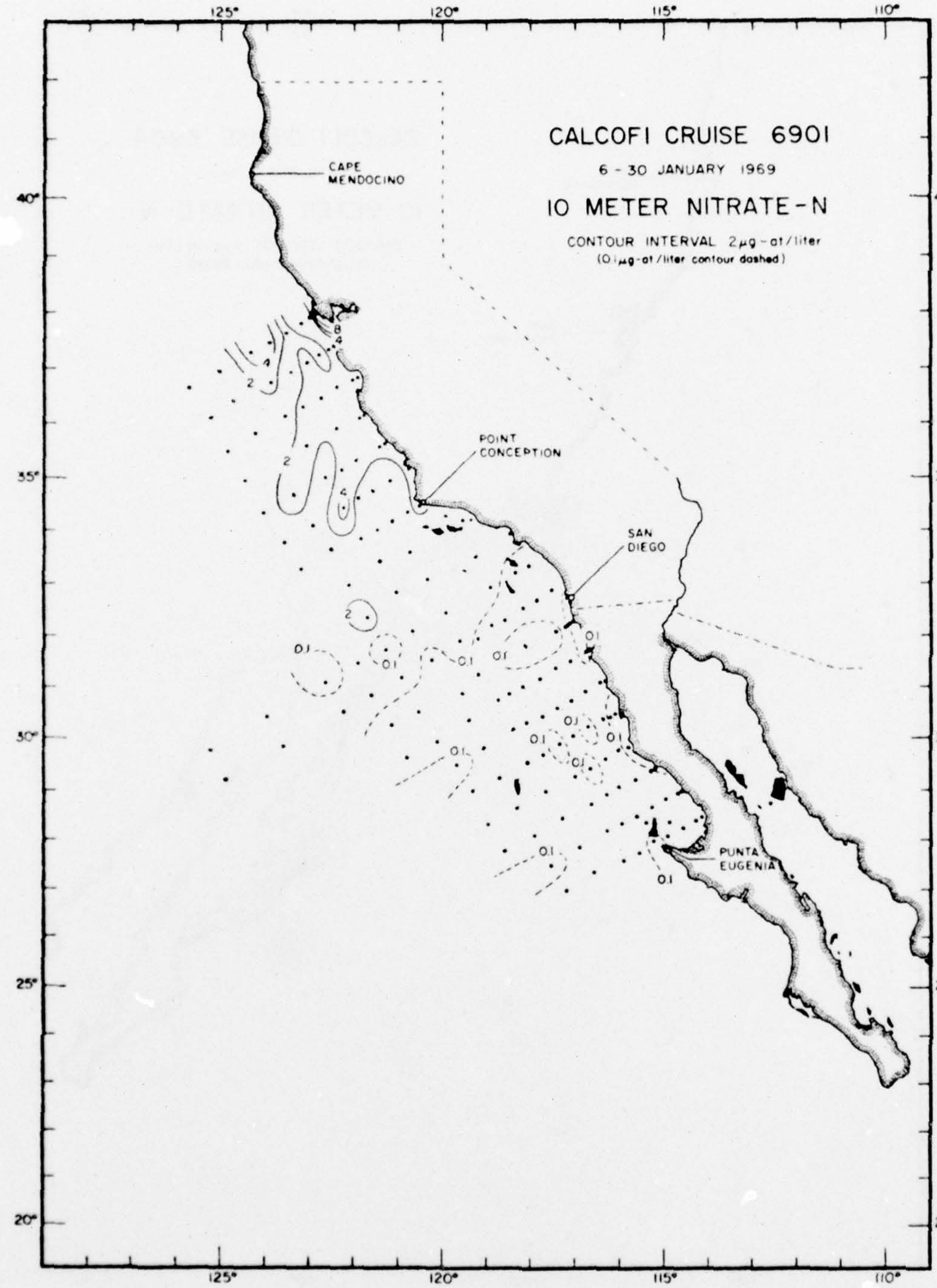


Figure 14. Nitrate nitrogen concentration, at 10 meters, for the southern California Current region – winter. (Duplicated from CALCOFI Atlas, Ref. 32)

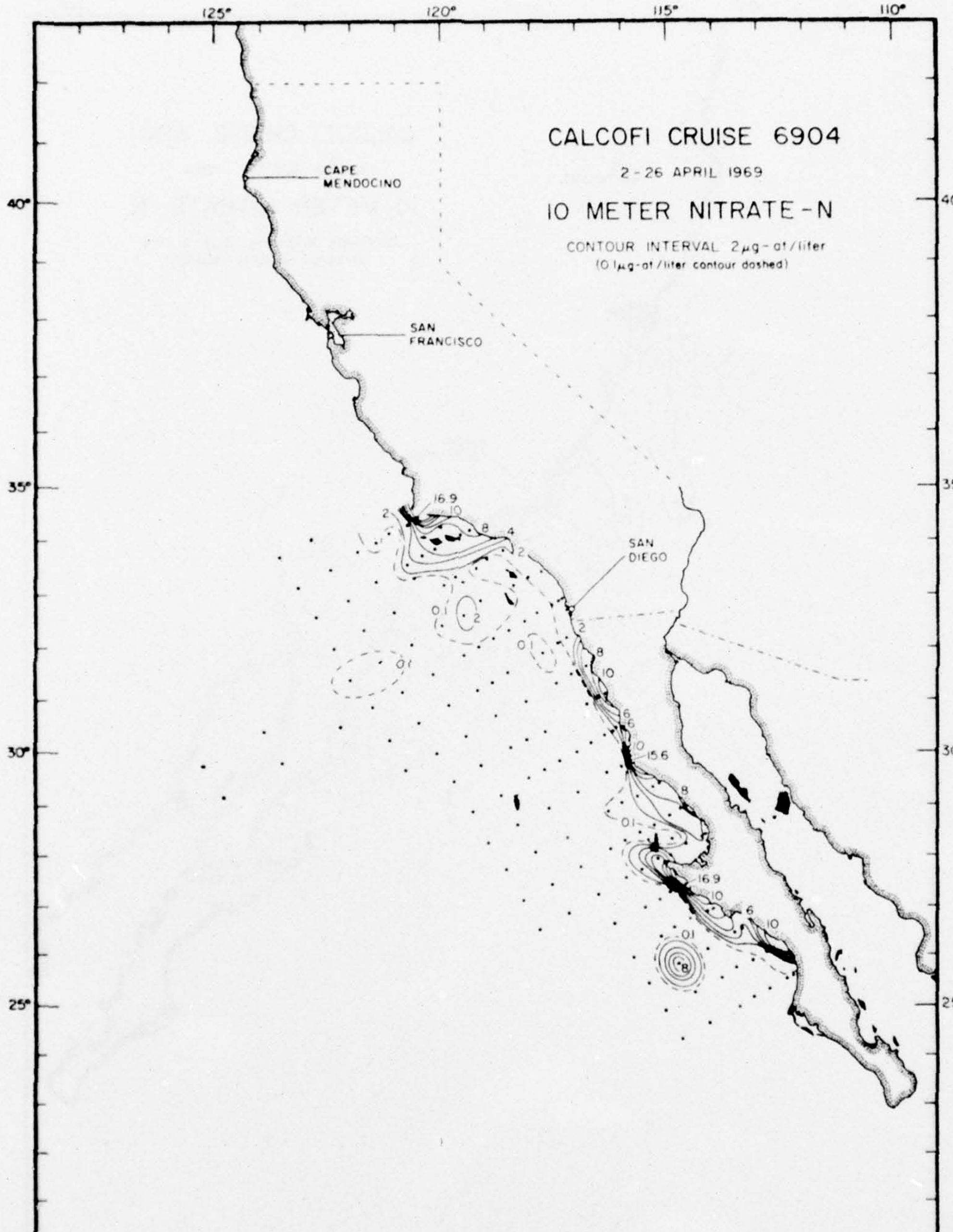


Figure 15. Nitrate nitrogen concentration at 10 meters for the southern California Current region – spring. (Duplicated from CALCOFI Atlas, Ref. 32)

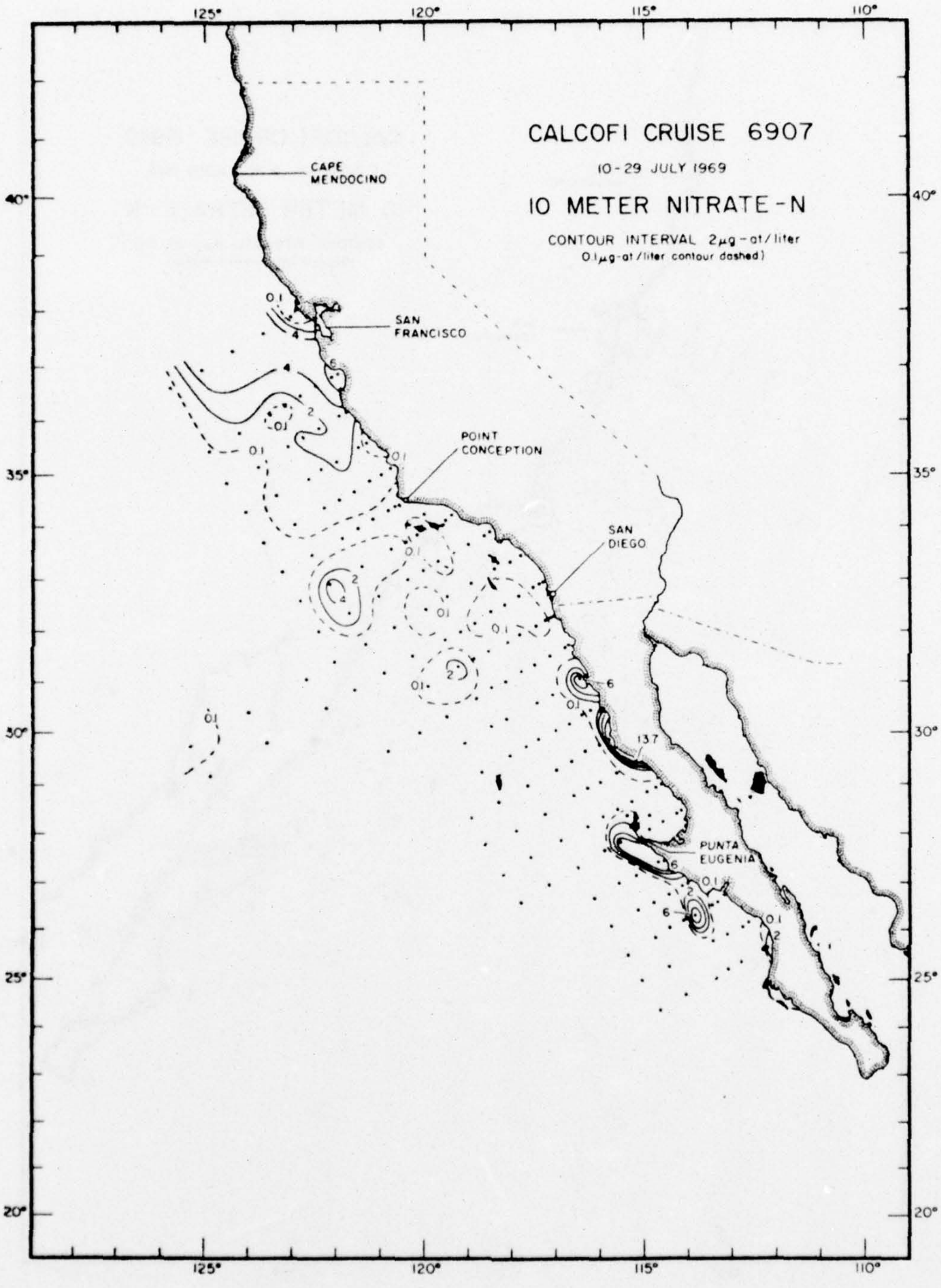


Figure 16. Nitrate nitrogen concentration at 10 meters for the southern California Current region – summer. (Duplicated from CALCOFI Atlas, Ref. 32)

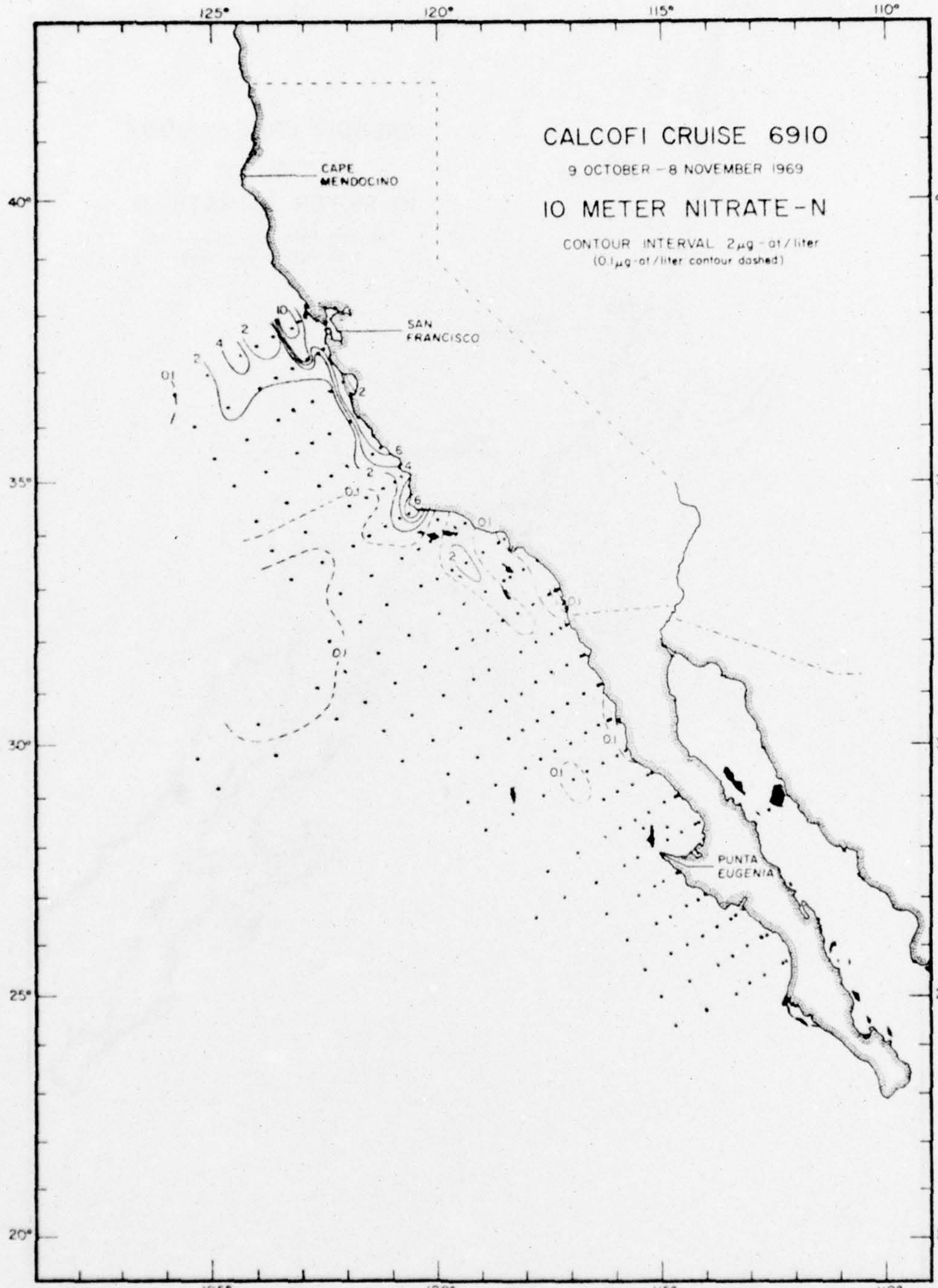


Figure 17. Nitrate nitrogen concentration at 10 meters for the southern California Current region – fall. (Duplicated from CALCOFI Atlas, Ref. 32)

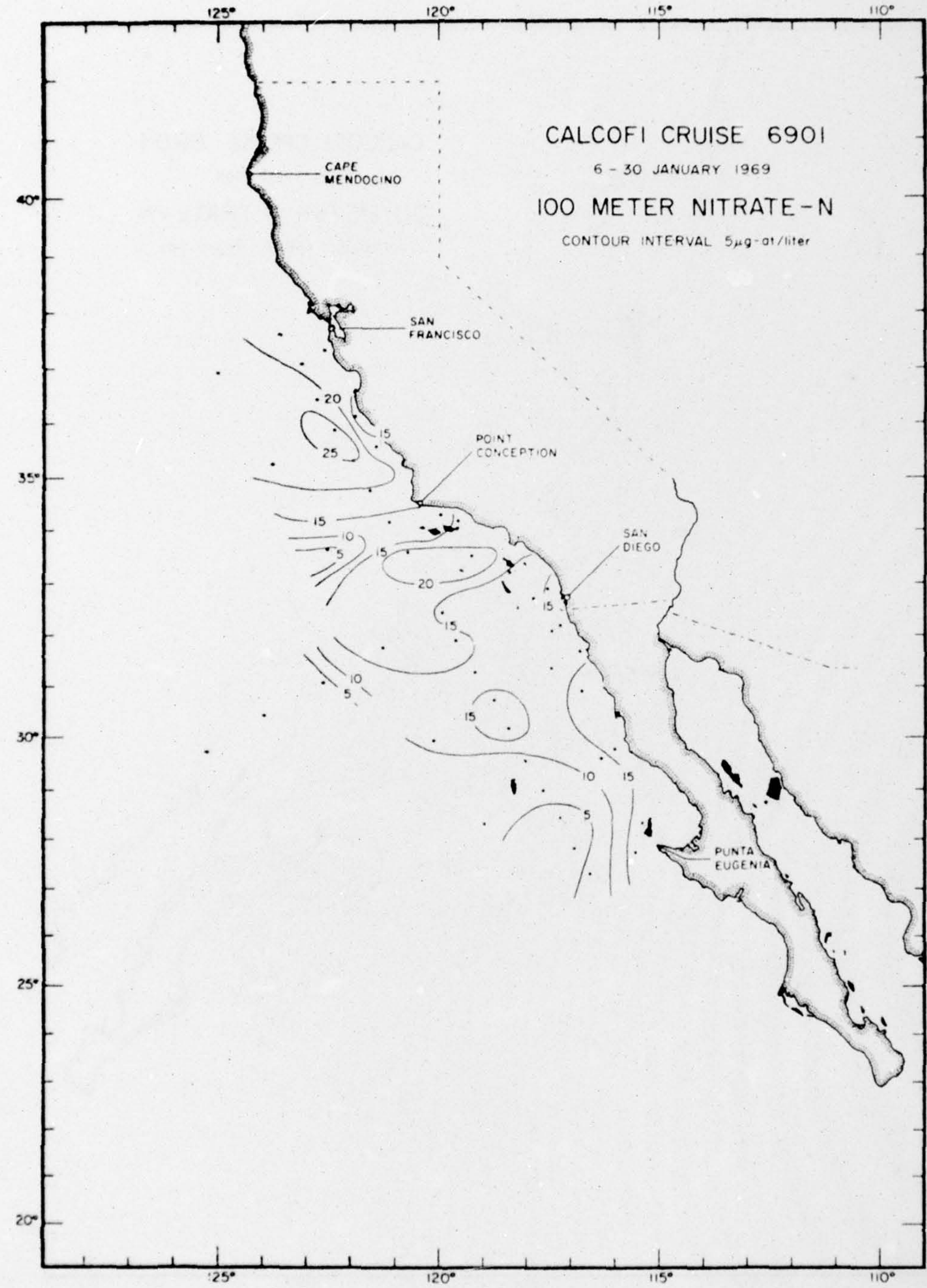


Figure 18. Nitrate nitrogen concentration at 100 meters for the southern California Current region – winter. (Duplicated from CALCOFI Atlas – Ref. 32)

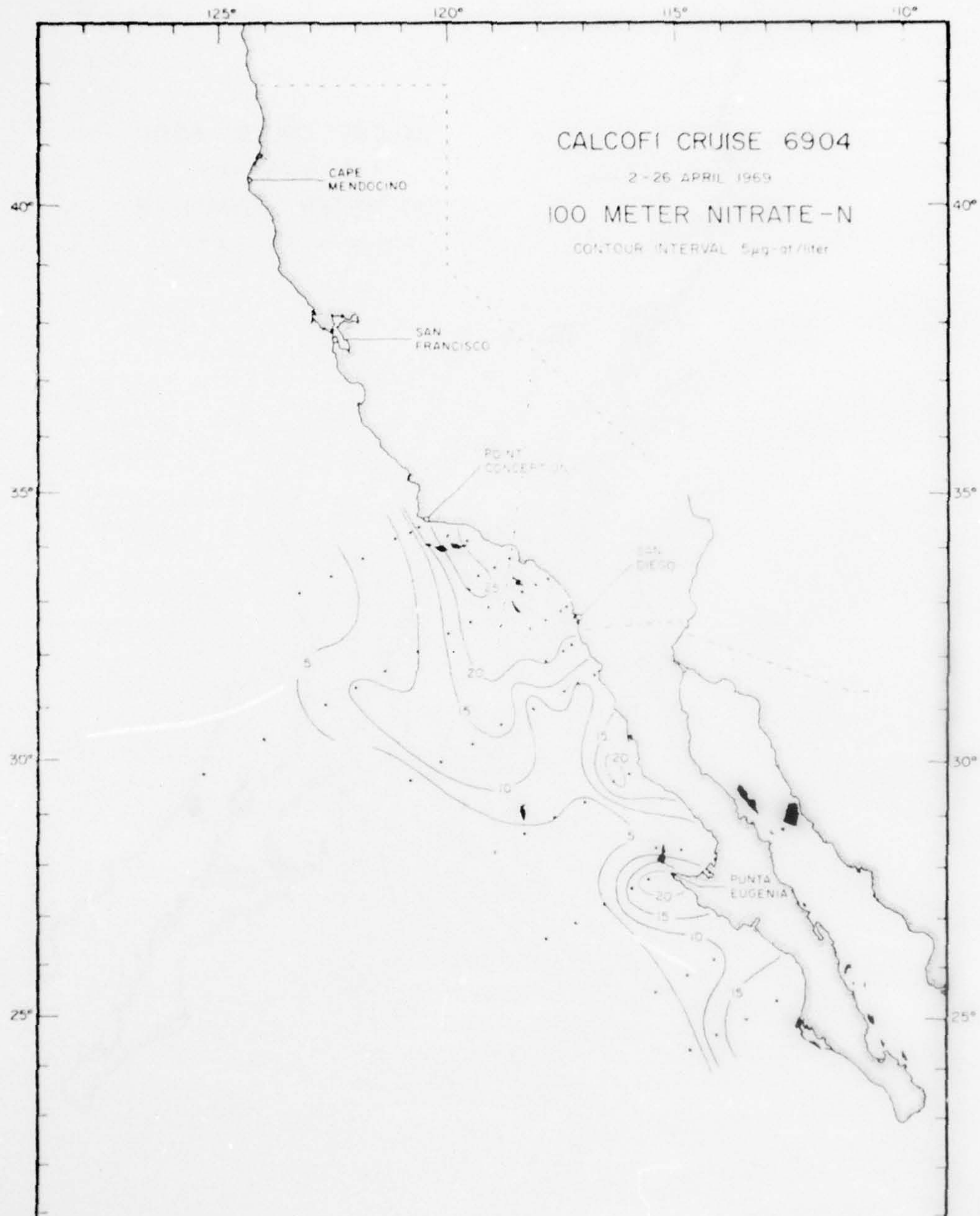


Figure 19. Nitrate nitrogen concentration at 100 meters for the southern California Current region – spring. (Duplicated from CALCOFI Atlas, Ref. 32)

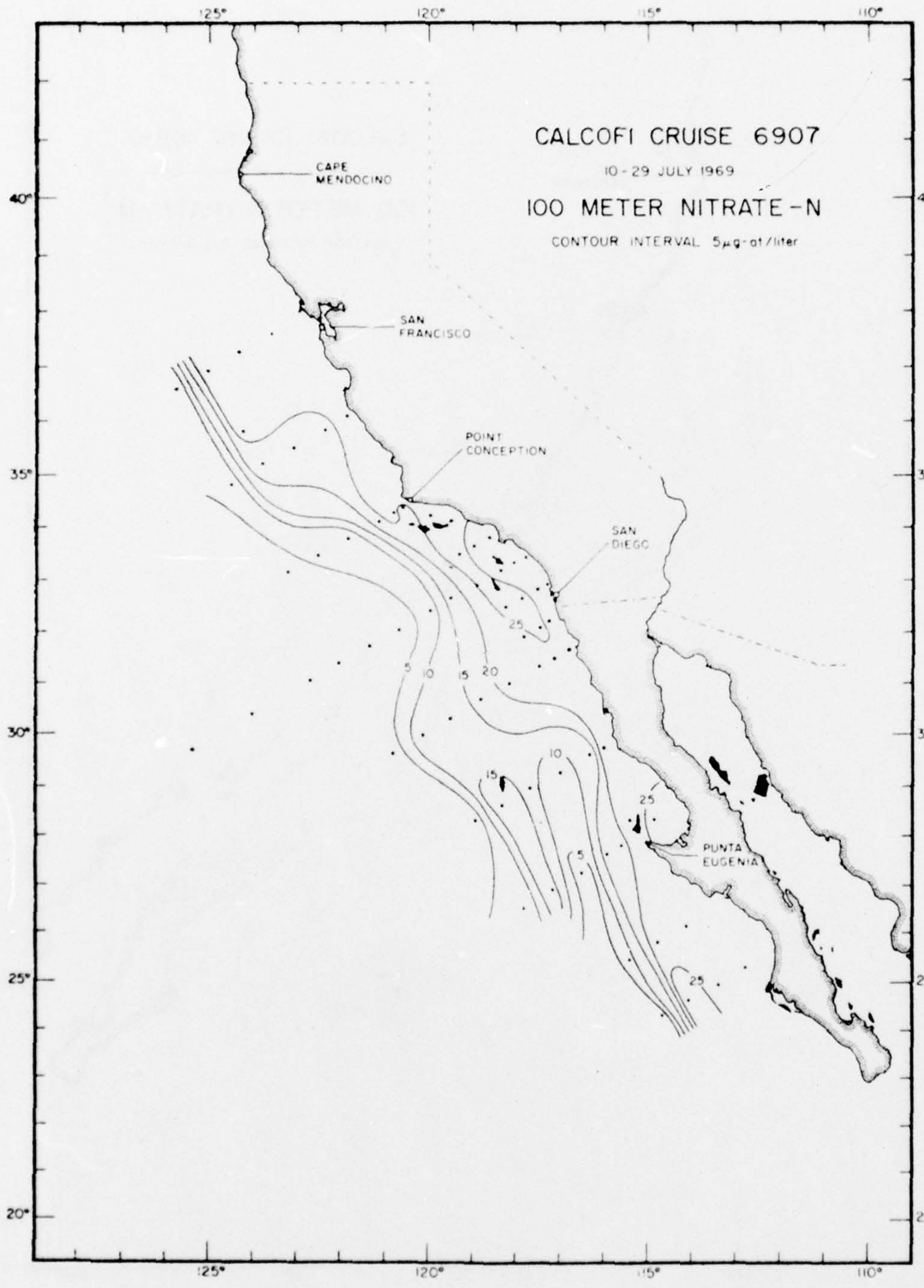


Figure 20. Nitrate nitrogen concentration at 100 meters for the southern California Current region – summer. (Duplicated from CALCOFI Atlas – Ref. 32)

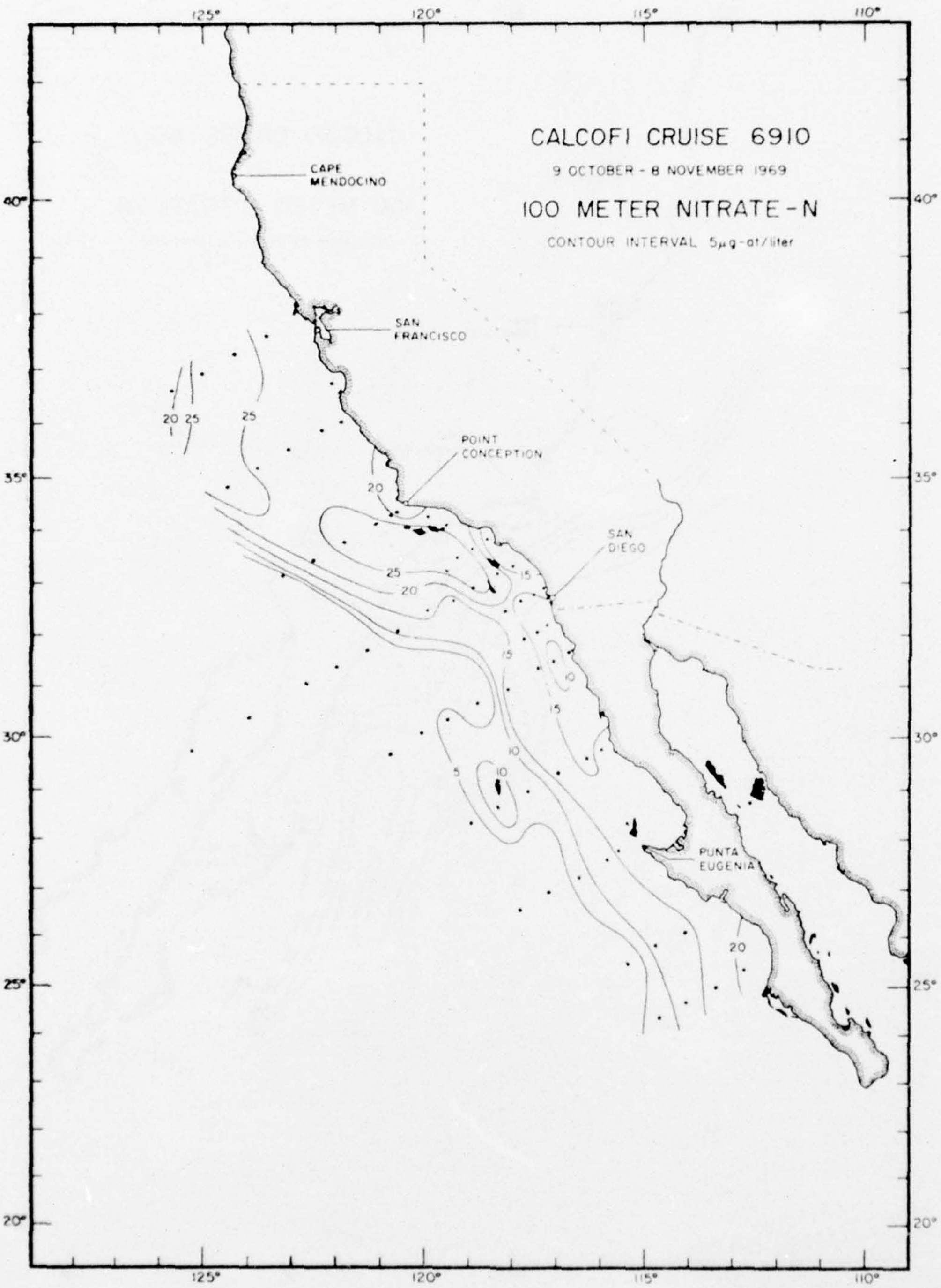


Figure 21. Nitrate nitrogen concentration at 100 meters for the southern California Current region – fall. (Duplicated from CALCOFI Atlas, Ref. 32)

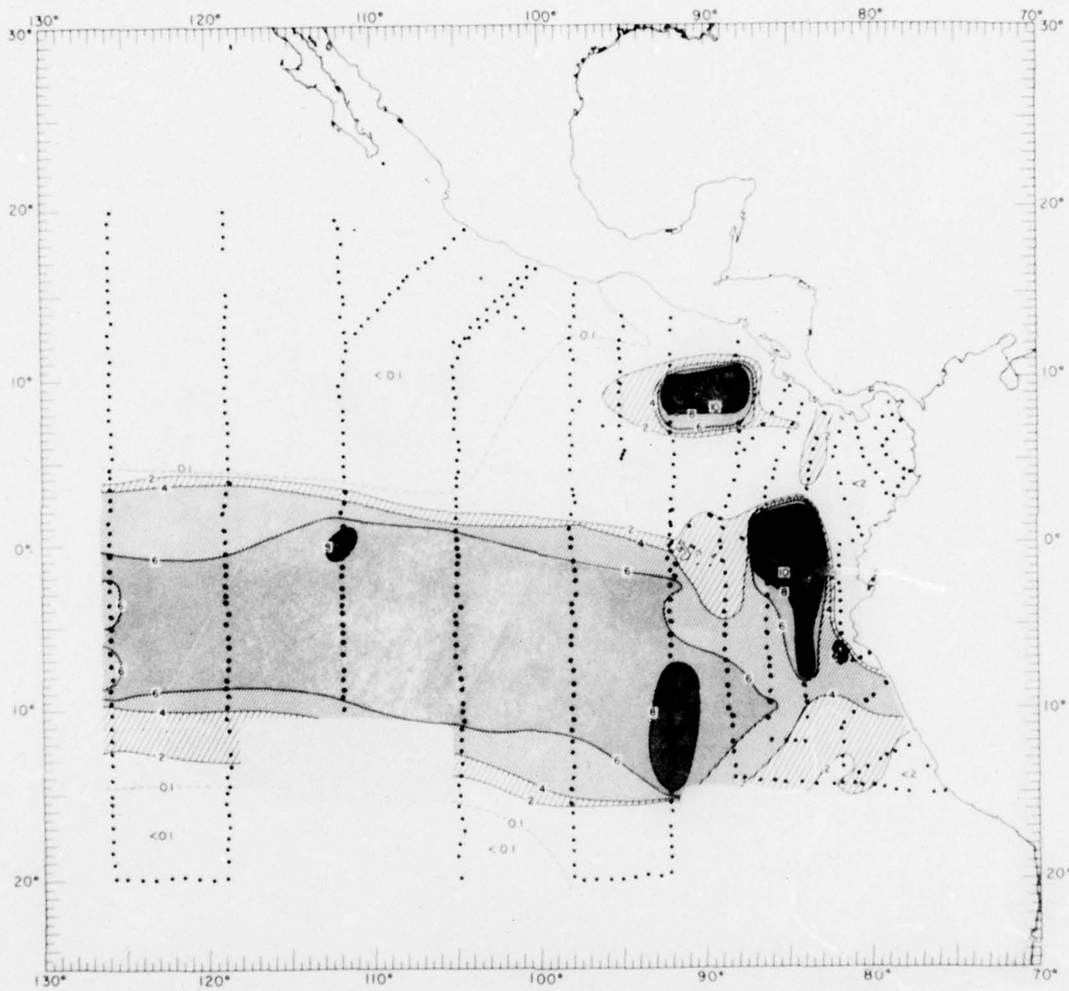


Figure 22. Nitrate-nitrogen (µg-at/liter) concentration at 10 meters; Feb-Mar 1967, for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas Vol. 2, Ref. 22).

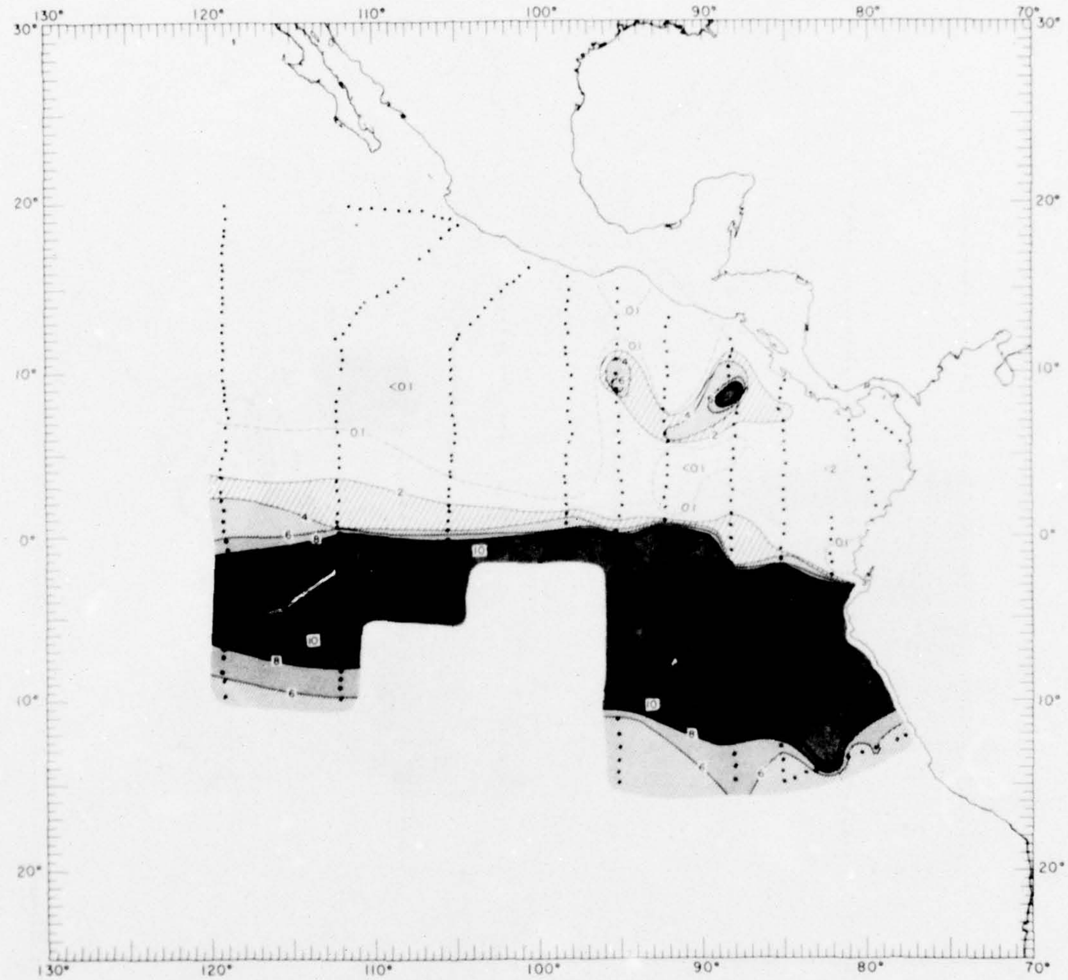


Figure 23. Nitrate-nitrogen (μg-at/liter) concentration at 10 meters; Aug-Sep 1967, for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas Vol. 6, Ref. 22).

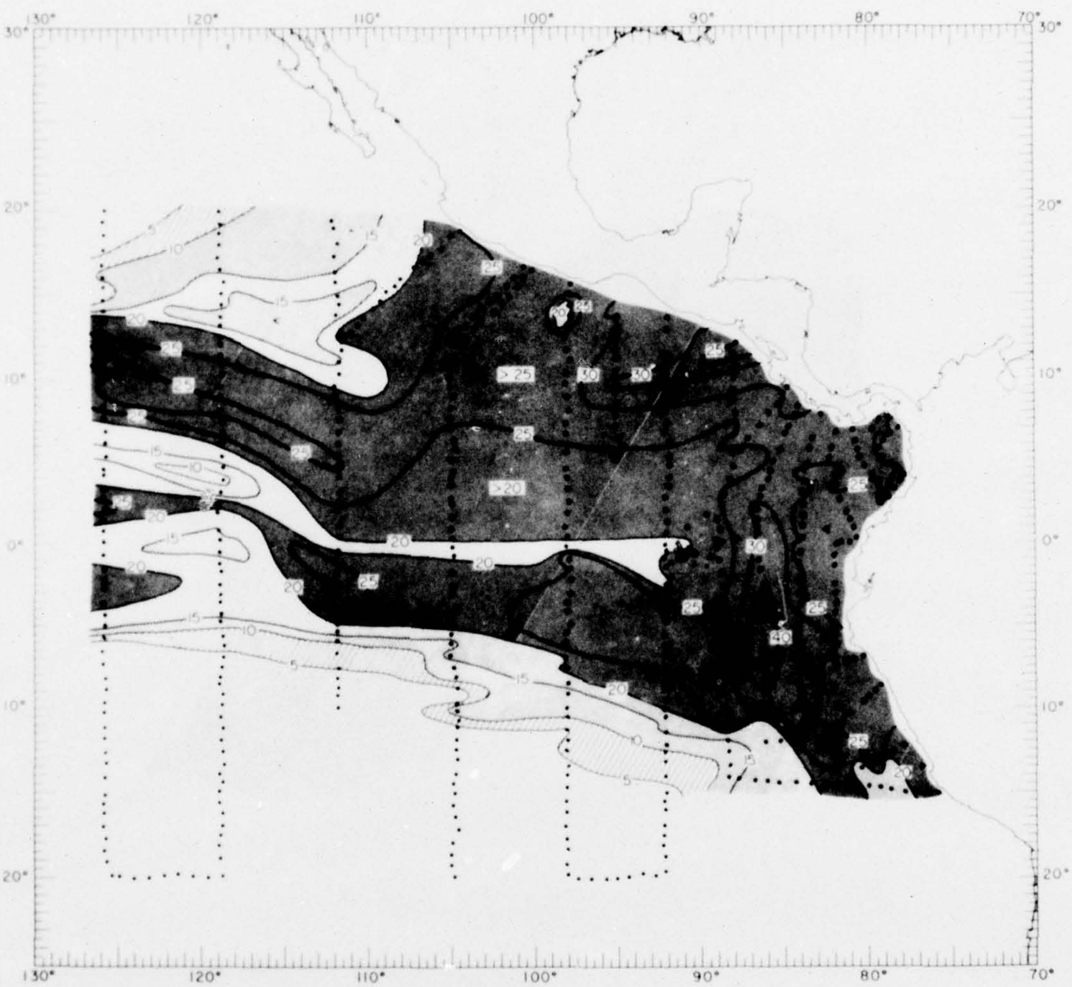


Figure 24. Nitrate-nitrogen (μg-at/liter) at 100 meters Feb-Mar 1967 for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas, Vol. 2, Ref. 22)

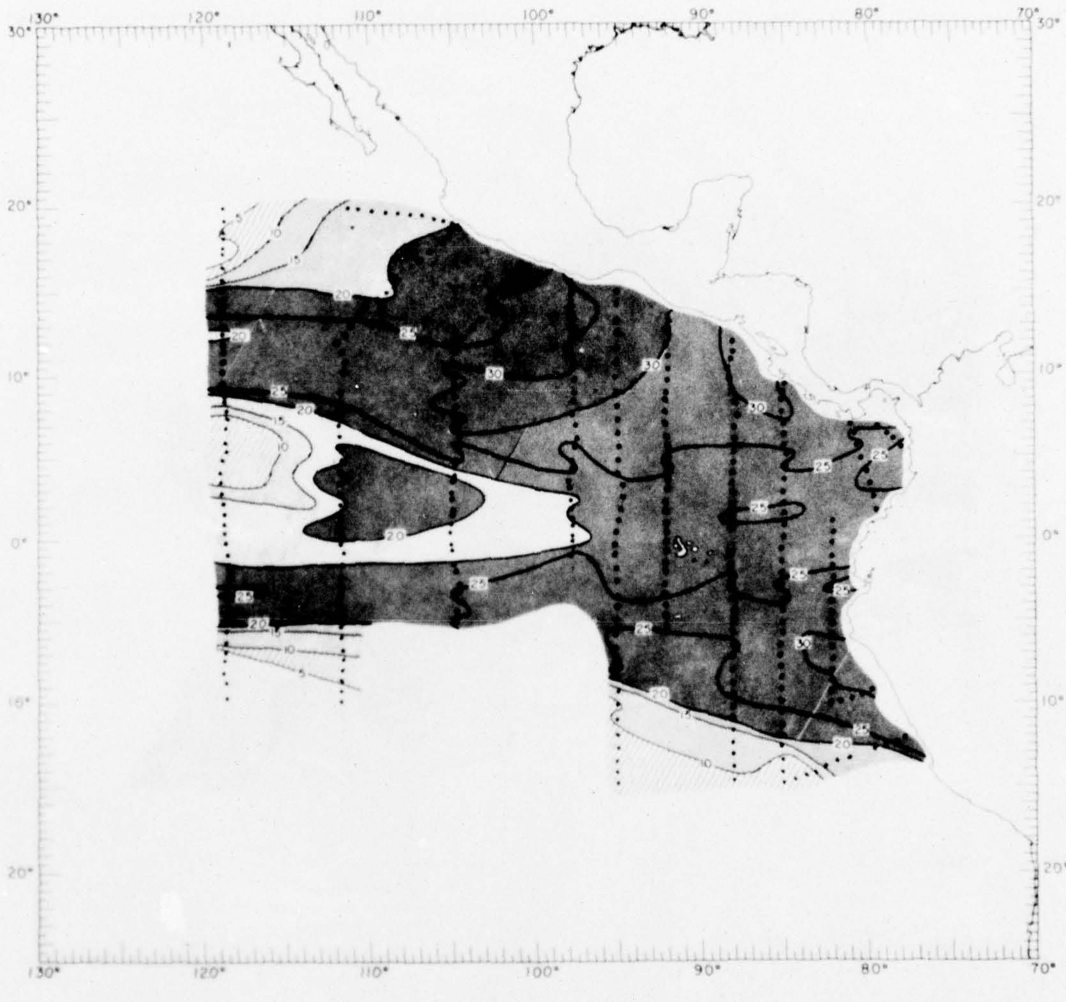


Figure 25. Nitrate-nitrogen (μg-at/liter) at 100 meters Aug-Sep 1967 for the eastern tropical Pacific. (Reproduced from EASTROPAC Atlas, Vol. 6, Ref. 22).

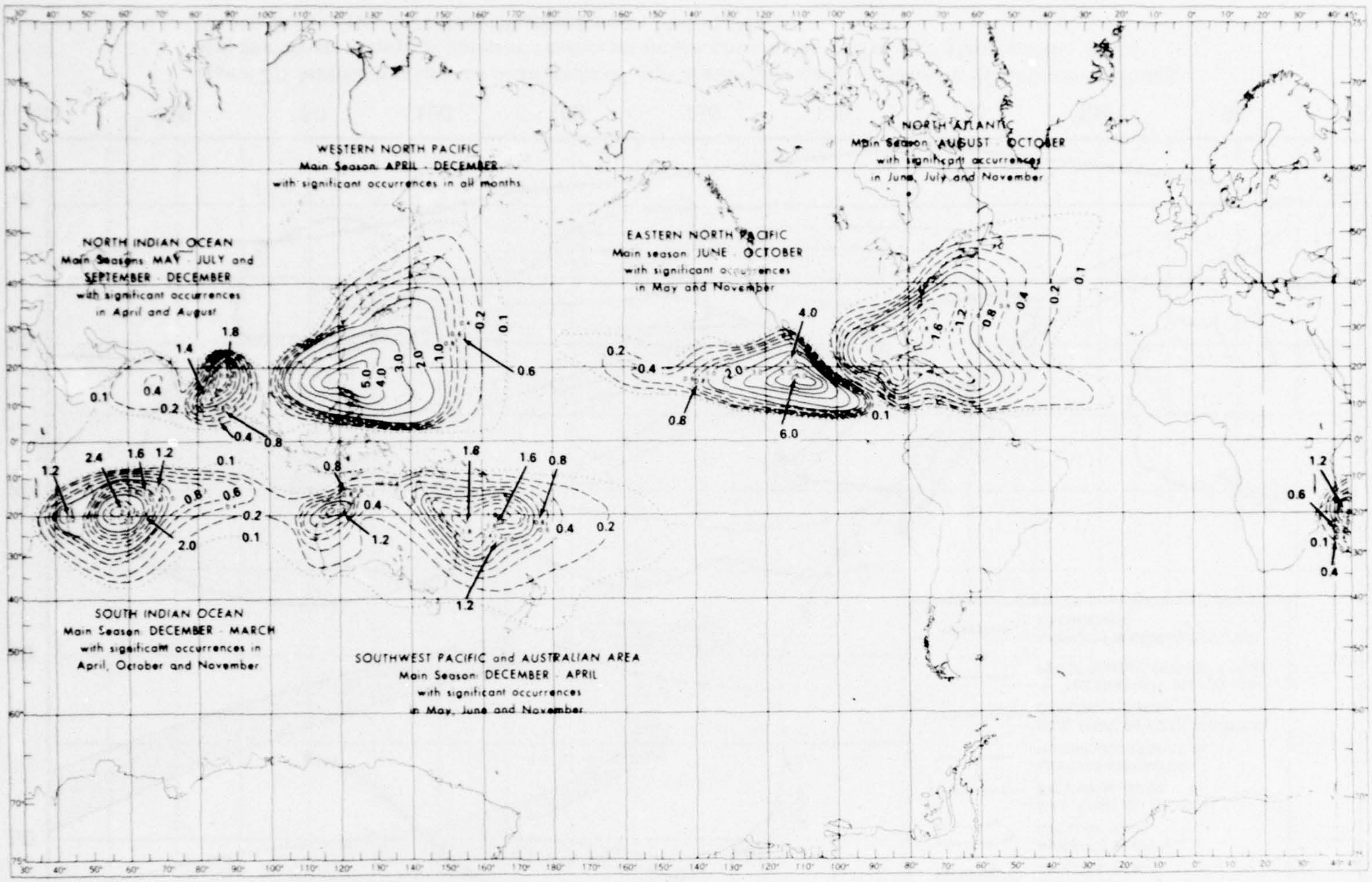


Figure 26. Average numbers of tropical cyclones per 5-degree square per year. Principal season for cyclonic activity is given. (Reproduced from Naval Weather Service, Ref. 34)

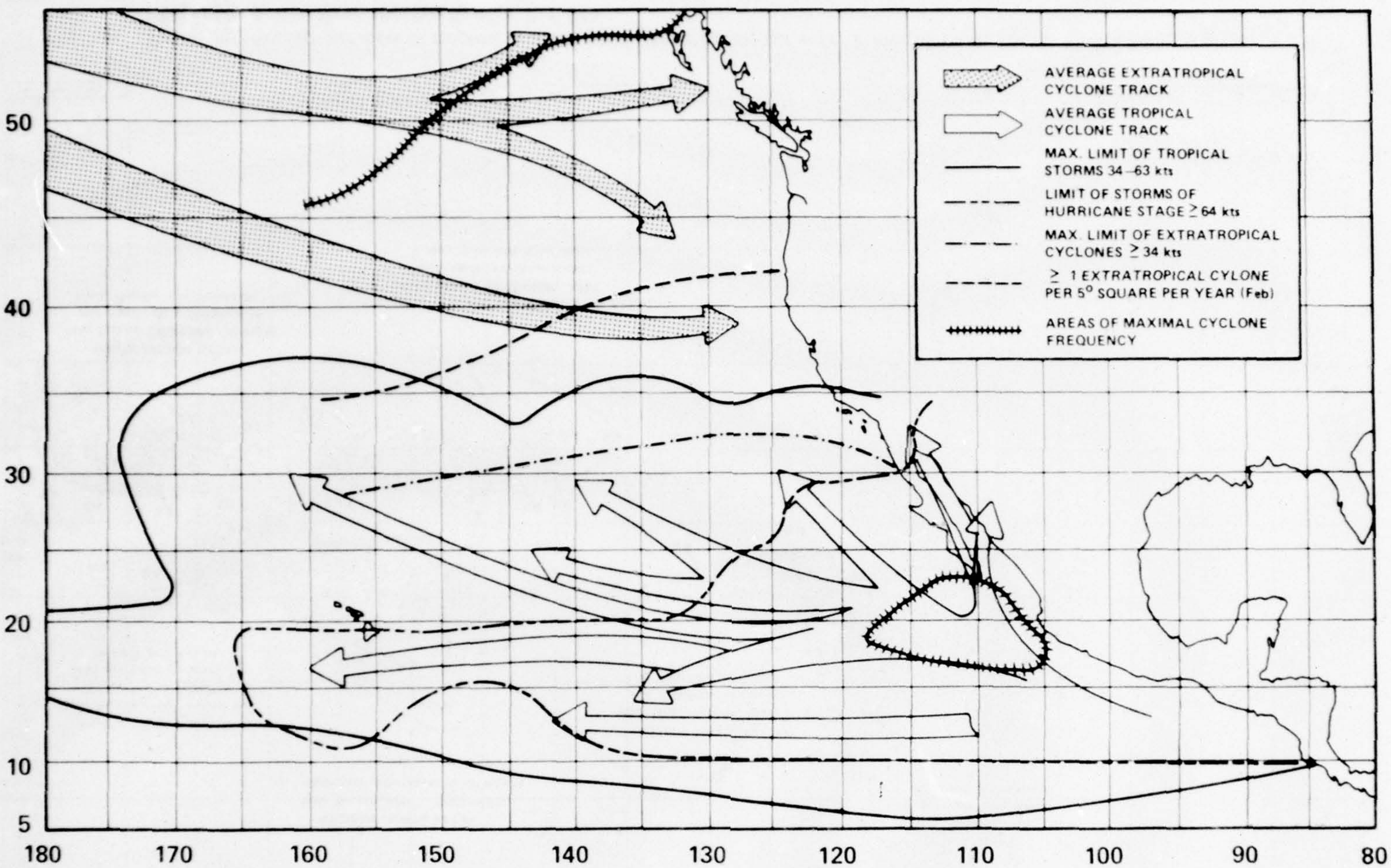


Figure 27. Maximum extent and mean tracks of tropical and extratropical cyclones for the northeastern Pacific. Maximum limits of tropical storms and hurricanes are also given. (1 kt ≈ 0.5 m/sec). (Data sources: Naval Weather Service, Ref. 34, NOAA (Weather Bureau), Ref. 35, 36)

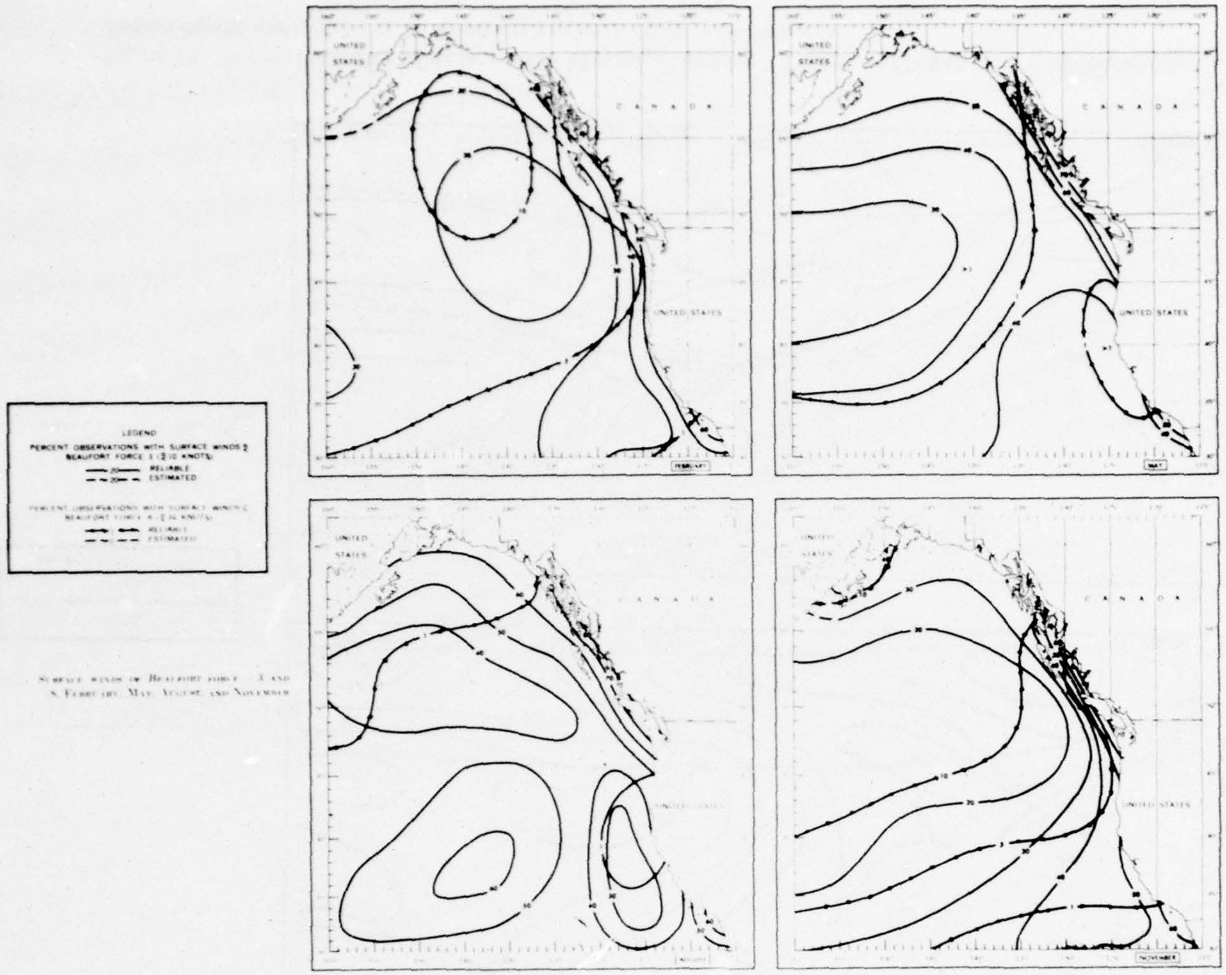


Figure 28. Percent frequency of surface winds ≤ Beaufort force 3 (10 kn) and ≥ 8 (34 kn) for Feb, May, Aug and Nov) in the northeast Pacific, north of 30°N. (1 knot ≈ 0.5 m/sec.) (U.S. Navy sources).

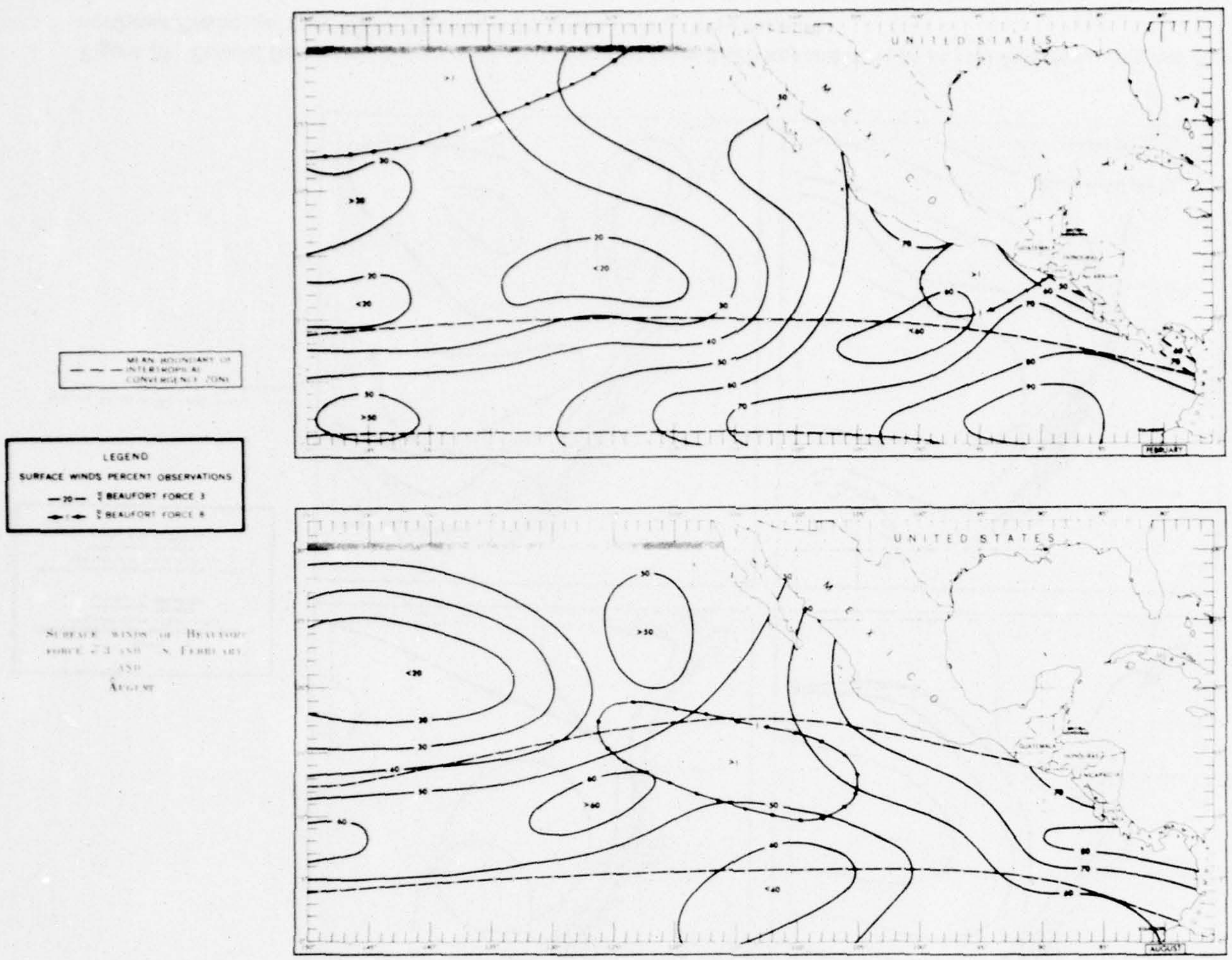


Figure 29. Percent frequency of surface winds of ⩽ Beaufort force 3 (10 kn) and ⩾ 8 (34 kn) for Feb and Aug for the eastern Pacific south of 30°N. (1 knot ≈ 0.5 m/sec.) (U. S. Navy sources).

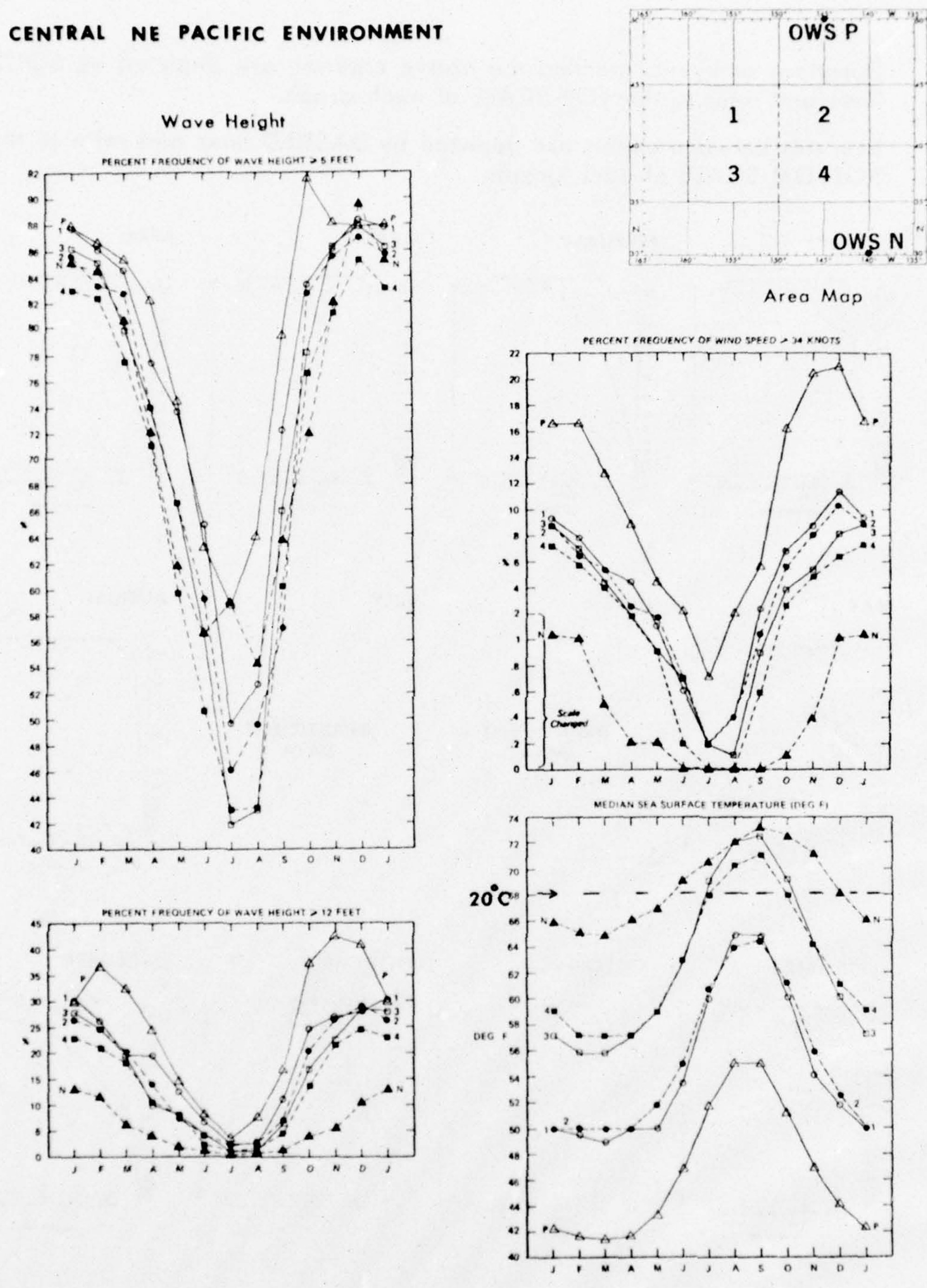


Figure 30. Environmental data for the central northeast Pacific showing monthly percent frequency of wave height ≥5 and ≥12 ft, wind speed ≥34 kn and median sea surface temperature. Area map gives location of Ocean Weather Station N and P and sample regions 1-4. (1 knot ≈ 0.5 m/sec; 1 ft ≈ 0.3 meters) (Data from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

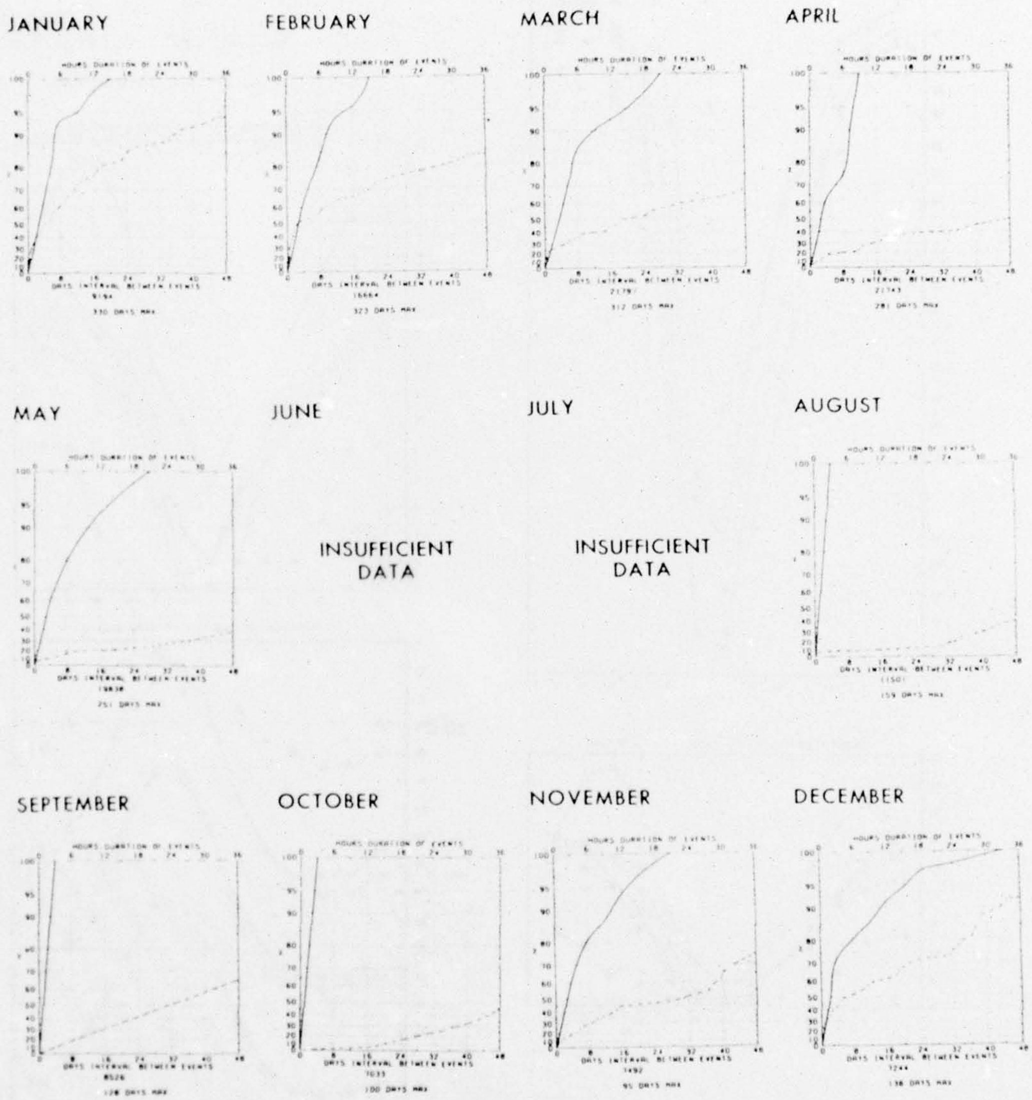


Figure 31. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station N giving percent frequency of duration and interval between 17 m/sec or greater winds. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

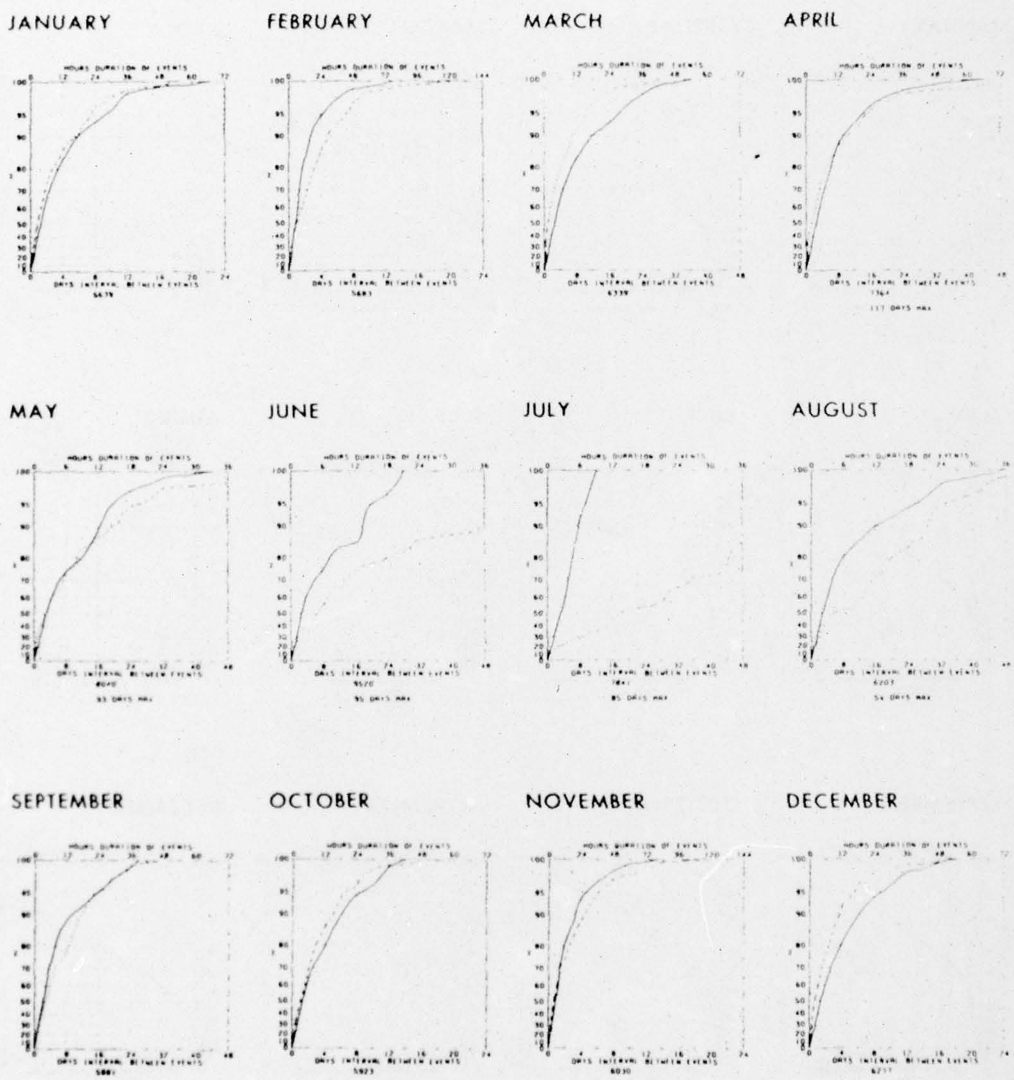


Figure 32. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station P giving percent frequency of duration of and interval between 17 m/sec or greater winds. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

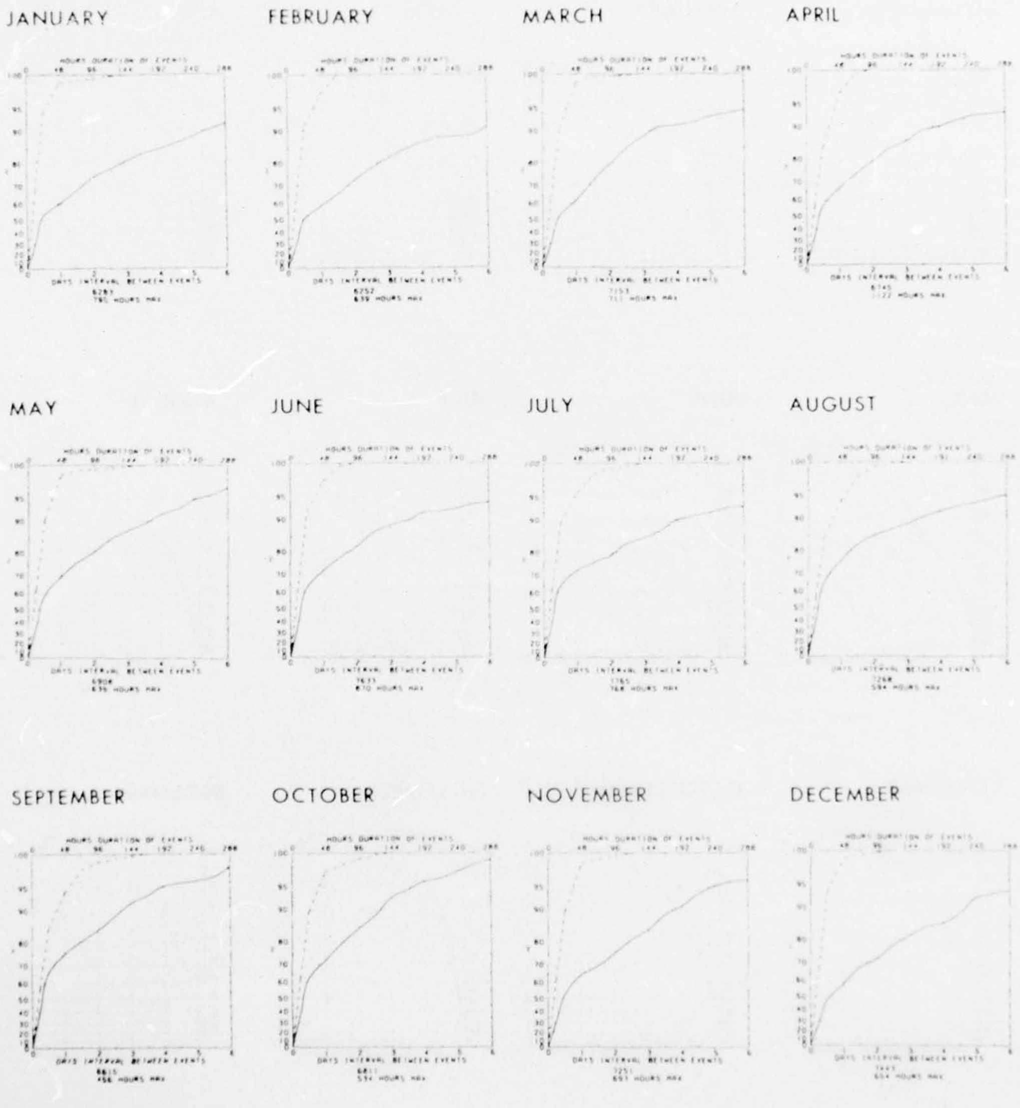


Figure 33. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station N giving percent frequency of duration of and interval between 2.5 m/sec or greater winds. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

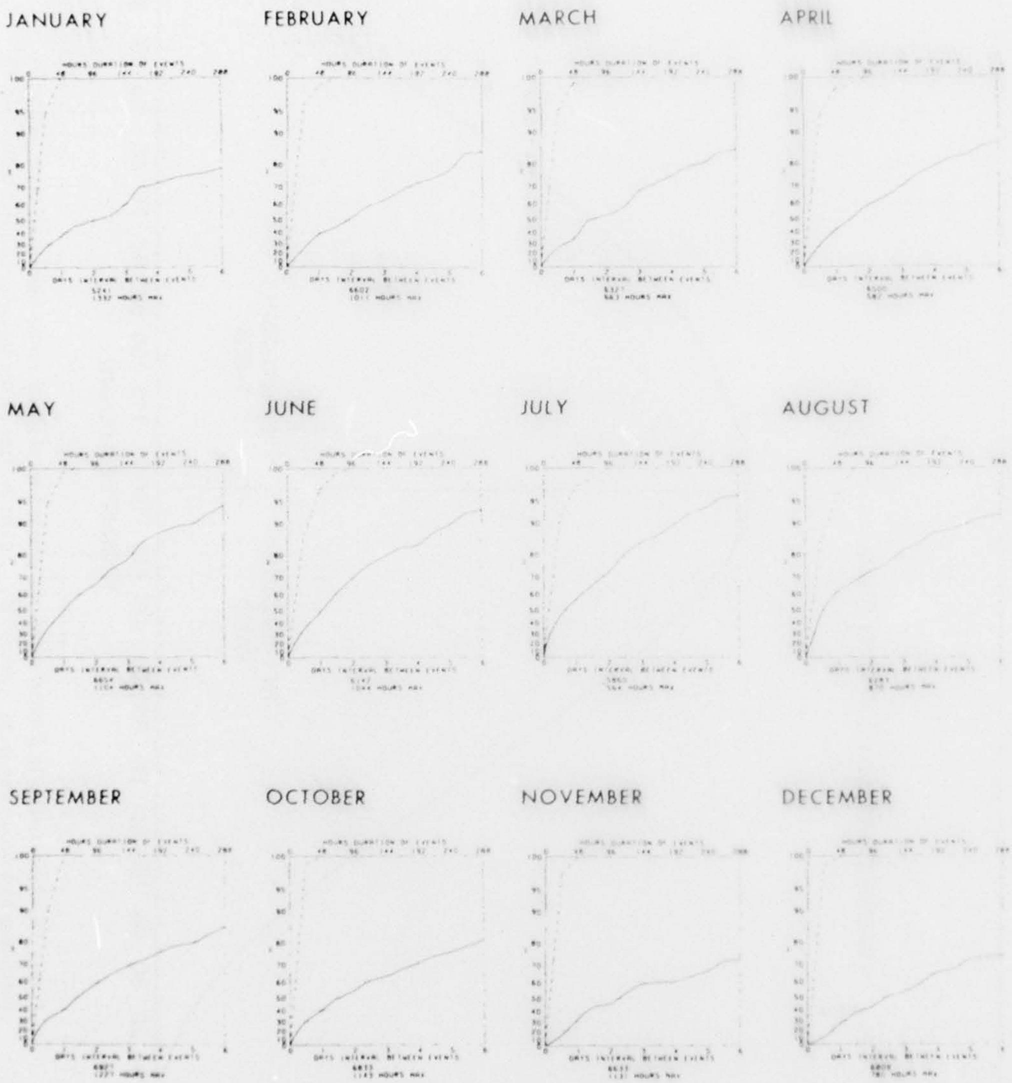


Figure 34. Wind speed persistence graph for the central northeast Pacific for Ocean Weather Station P giving percent frequency of duration of and interval between 25 m/sec or greater winds. (1 knot $\approx$ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 27).

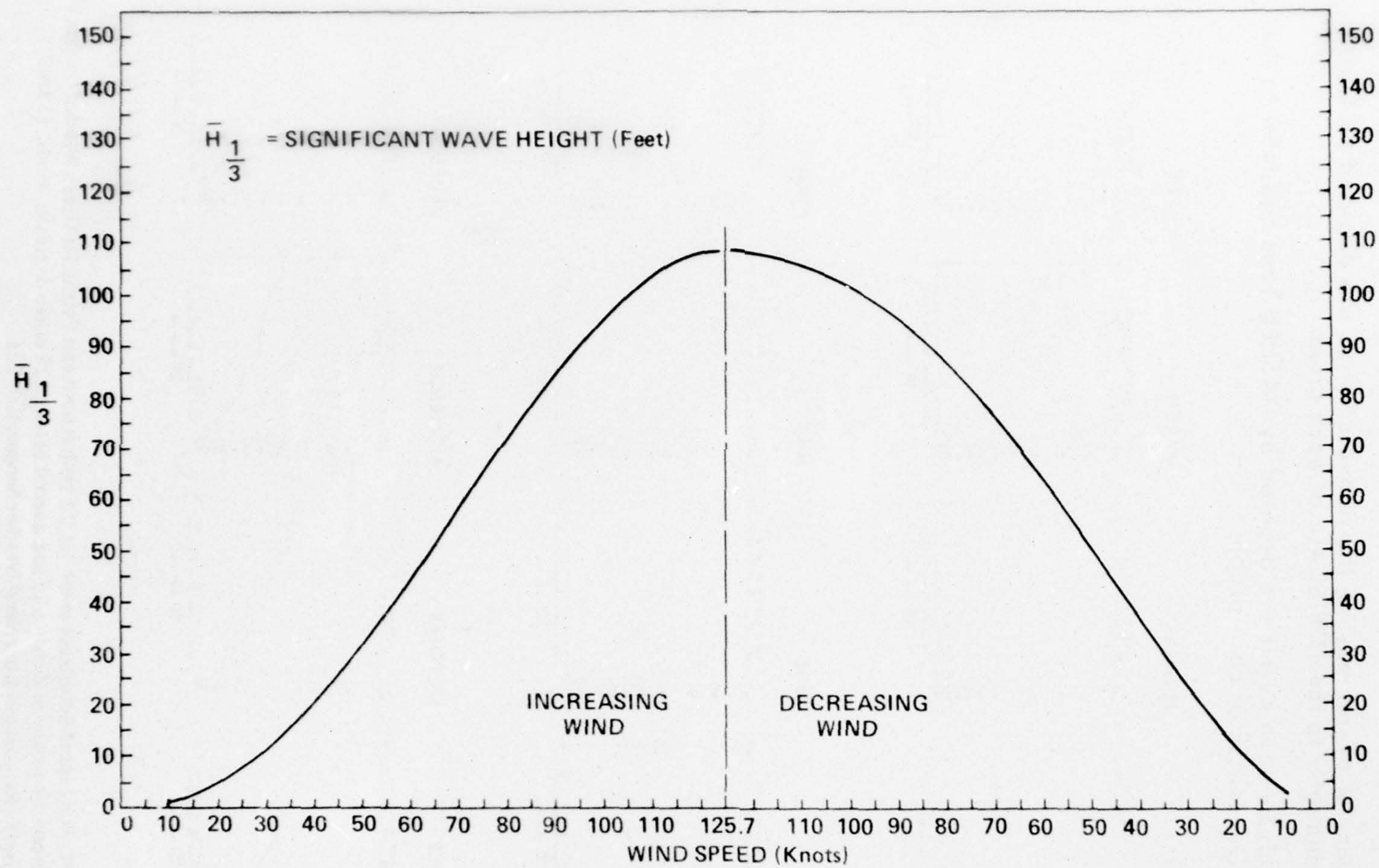


Figure 35. An empirically derived curve of sustained wind speed versus significant wave height for increasing and decreasing wind regimes. $\bar{H}_{1/3}$ is the average of the highest one third waves (significant wave). (1 knot ≈ 0.5 m/sec) (From U.S. Navy sources).

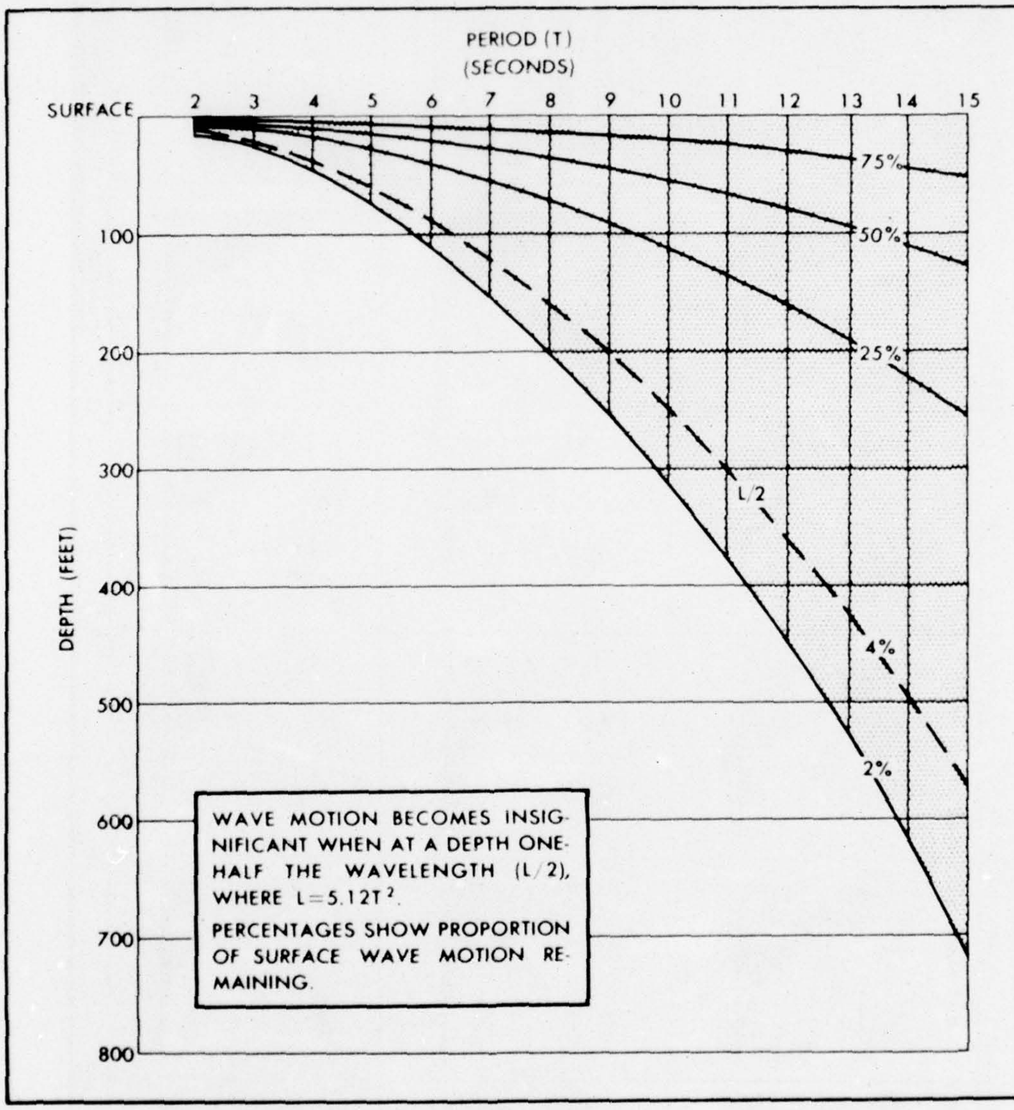


Figure 36. The percent attenuation of wave motion with depth given the period (T) in seconds. (1 foot ≈ 0.3 meter) (Data from U.S. Navy sources).

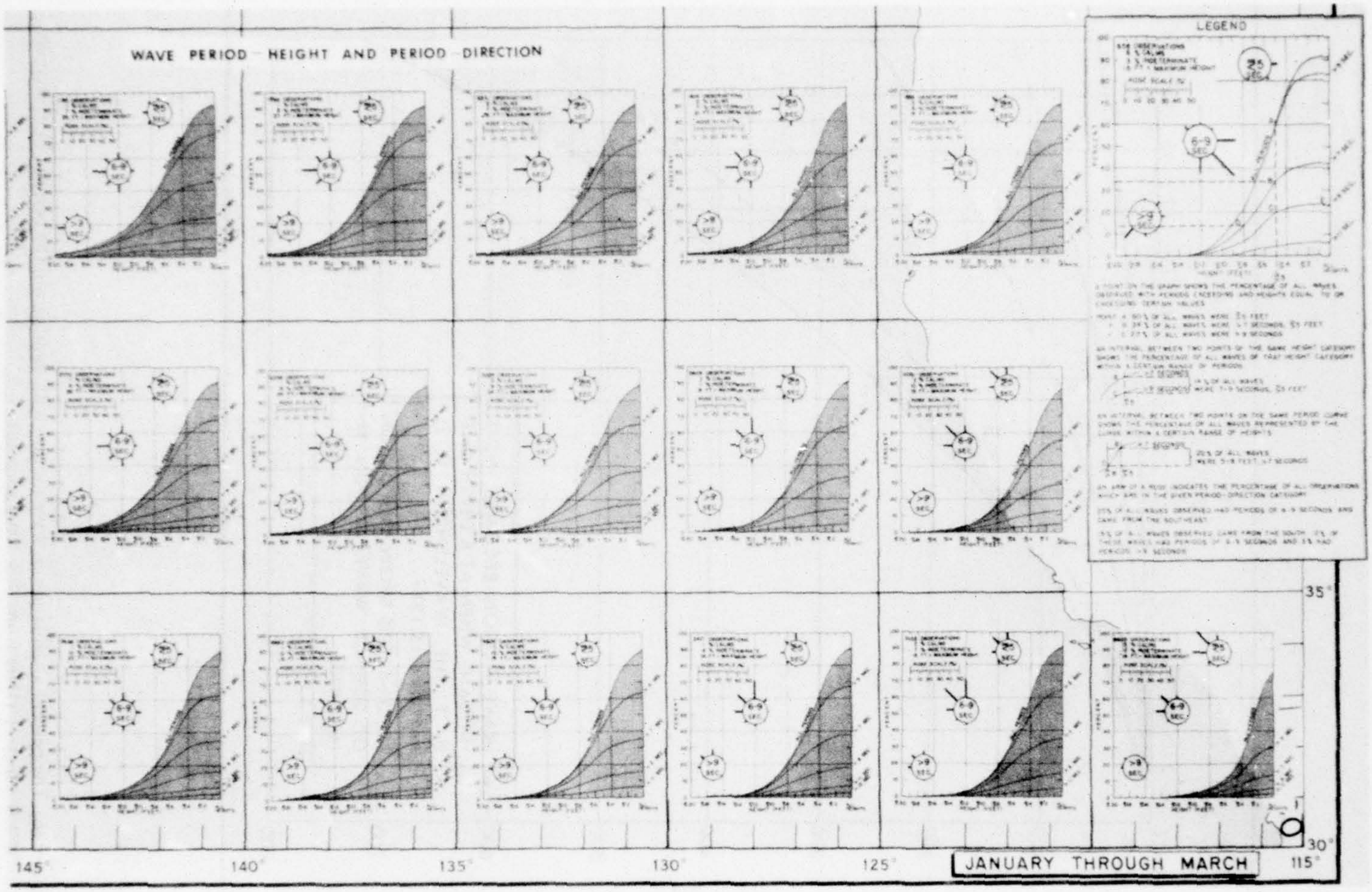


Figure 37. Percent frequency of wave height, period and direction for January through March for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

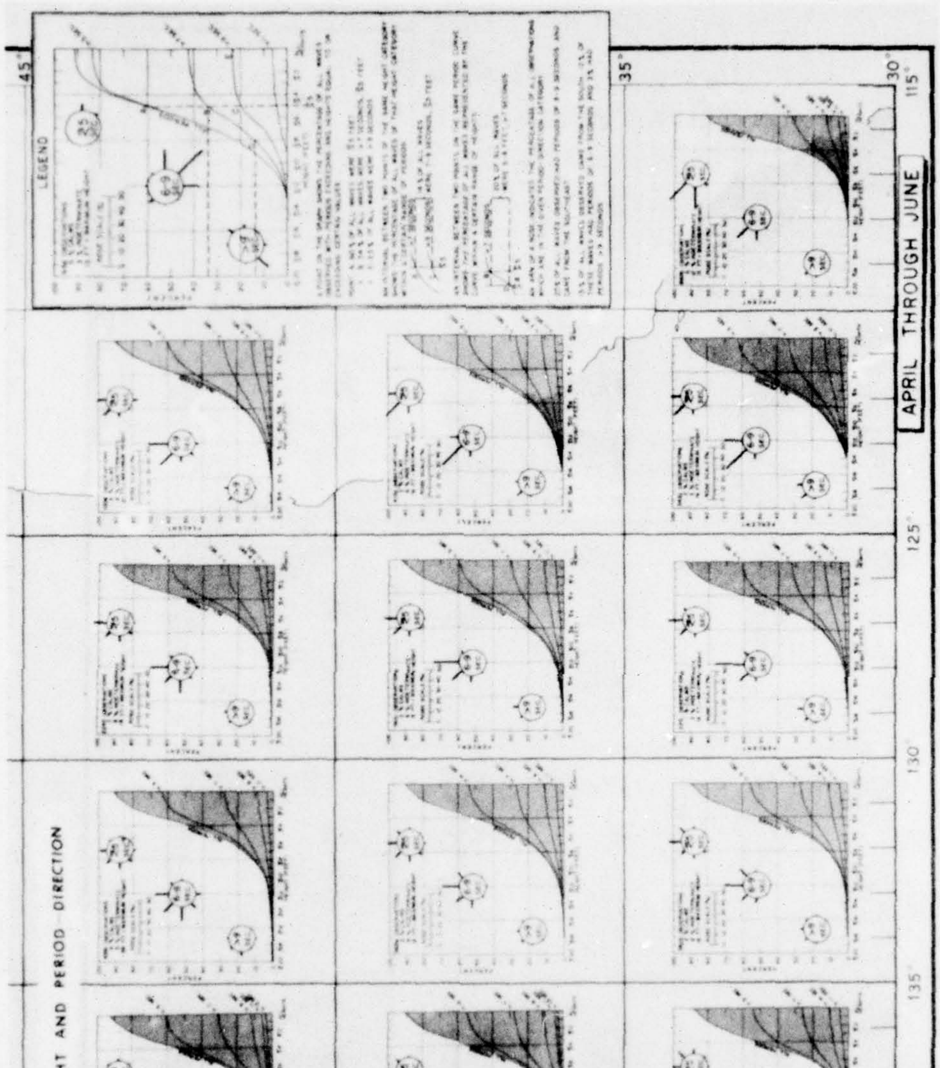


Figure 38. Percent frequency of wave height, period and direction for April through June for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

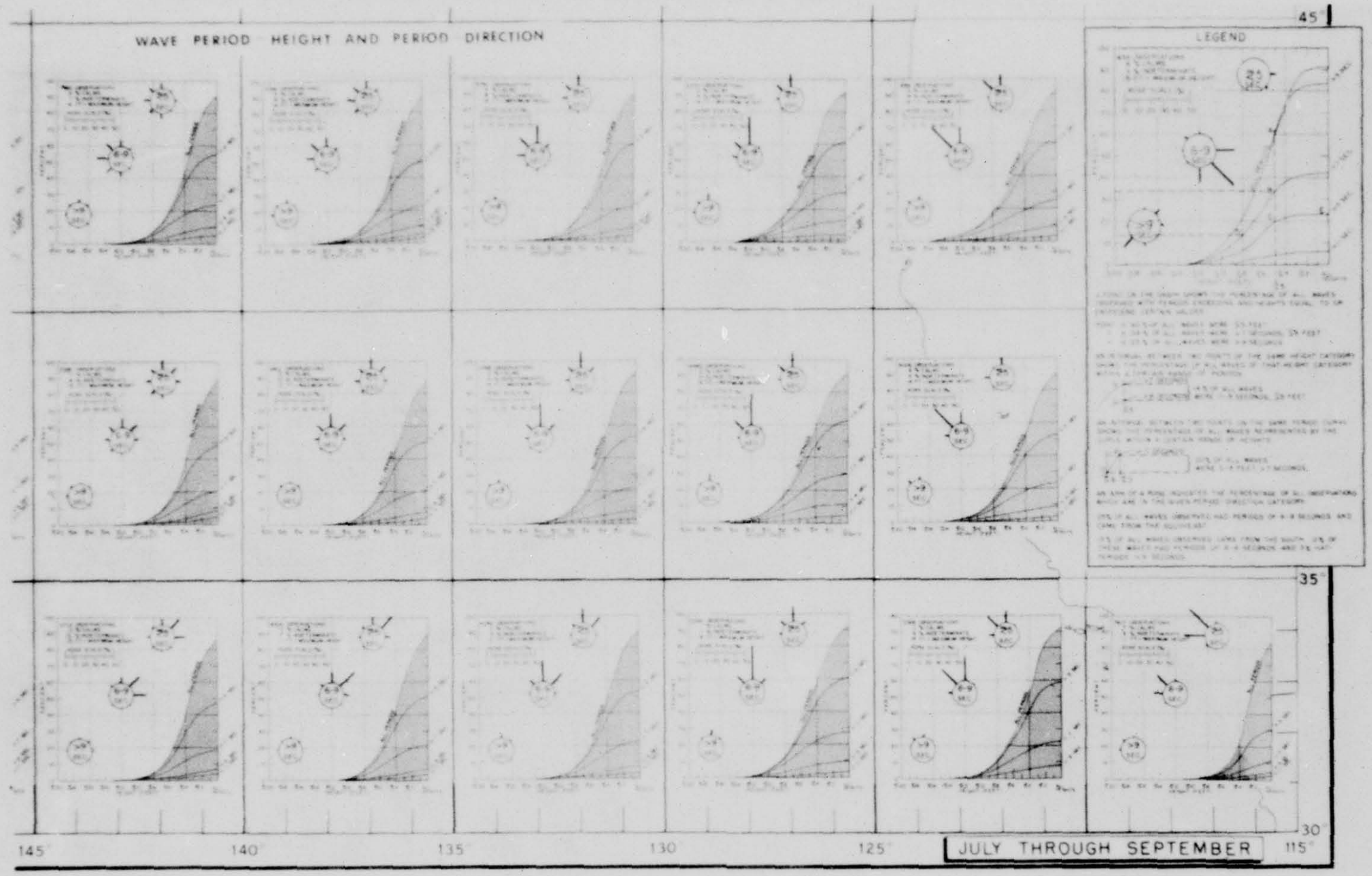


Figure 39. Percent frequency of wave height, period and direction for July through September for the northeastern Pacific 30° to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

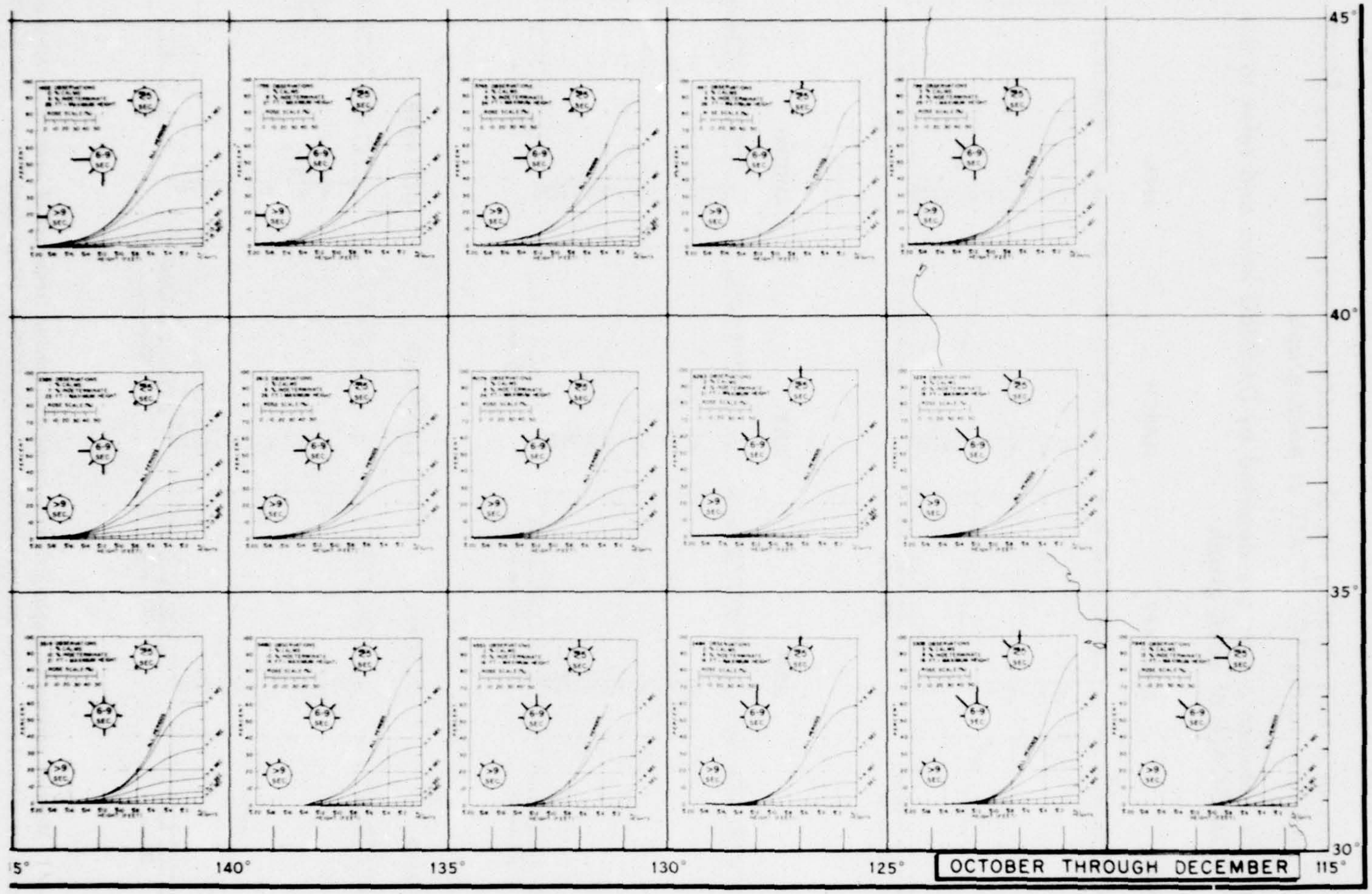


Figure 40. Percent frequency of wave height, period and direction for October through December for the northeastern Pacific 30°N to 45°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

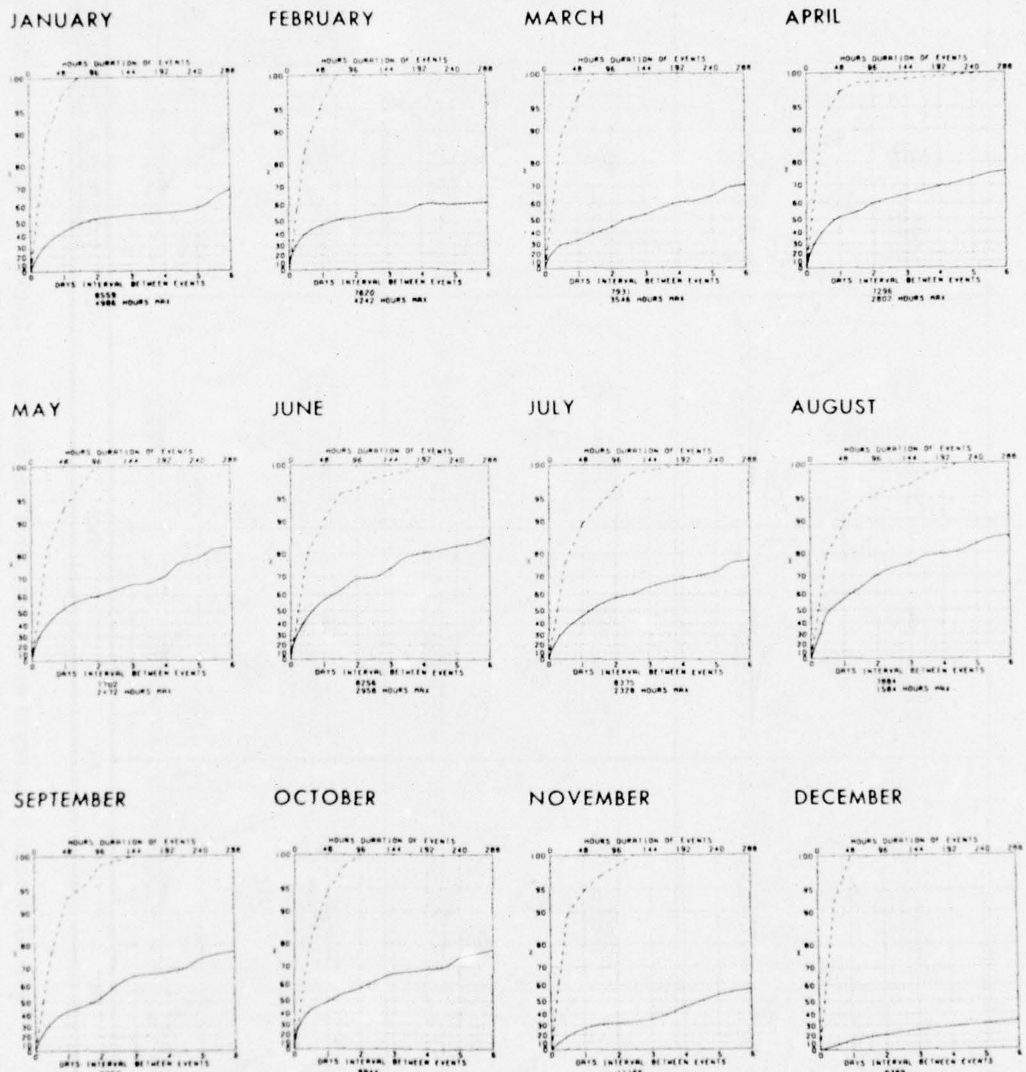


Figure 41. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ⩾ 1-meter wave event and of days interval between events for OWS N. (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

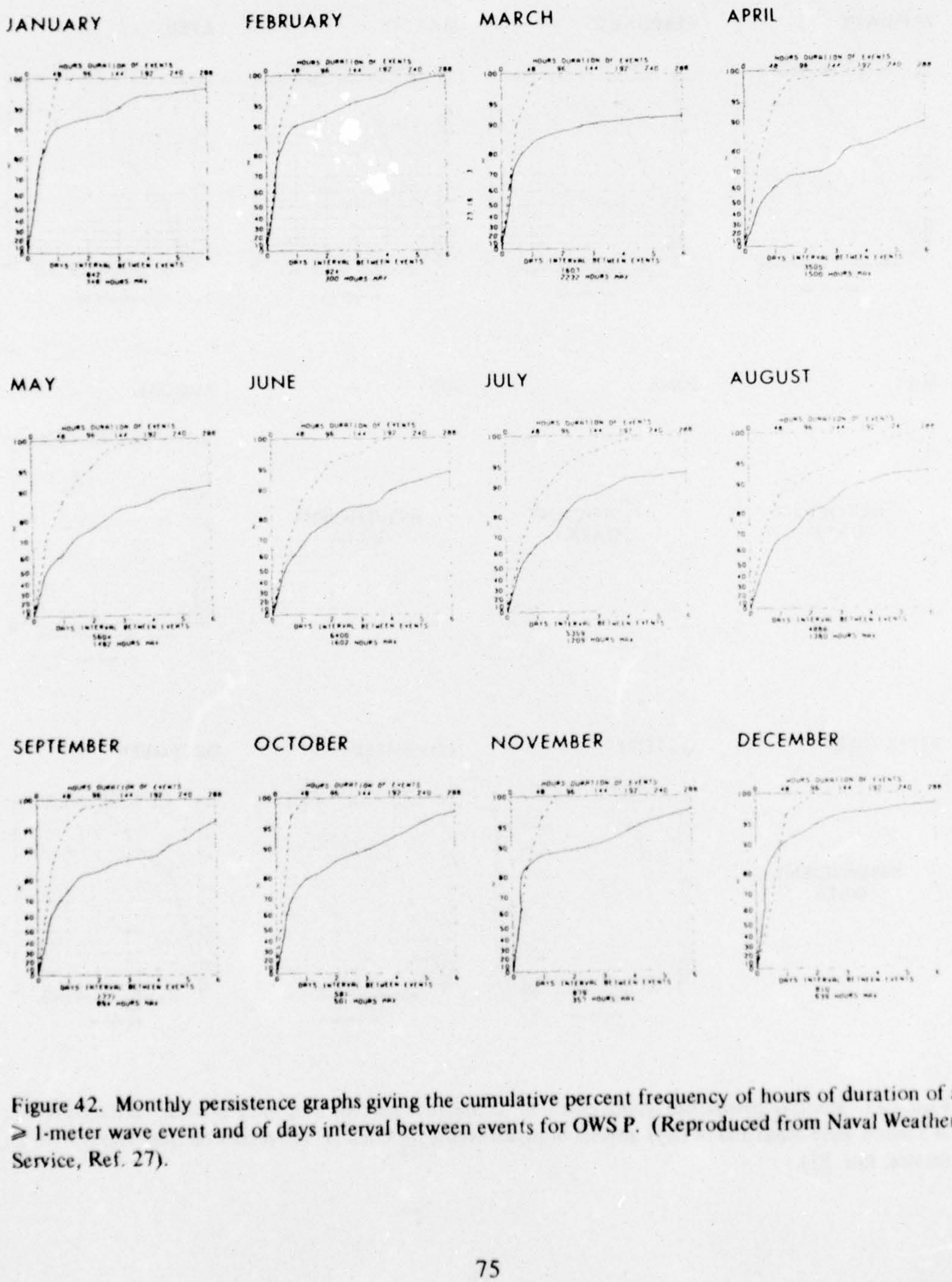


Figure 42. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ⩾ 1-meter wave event and of days interval between events for OWS P. (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

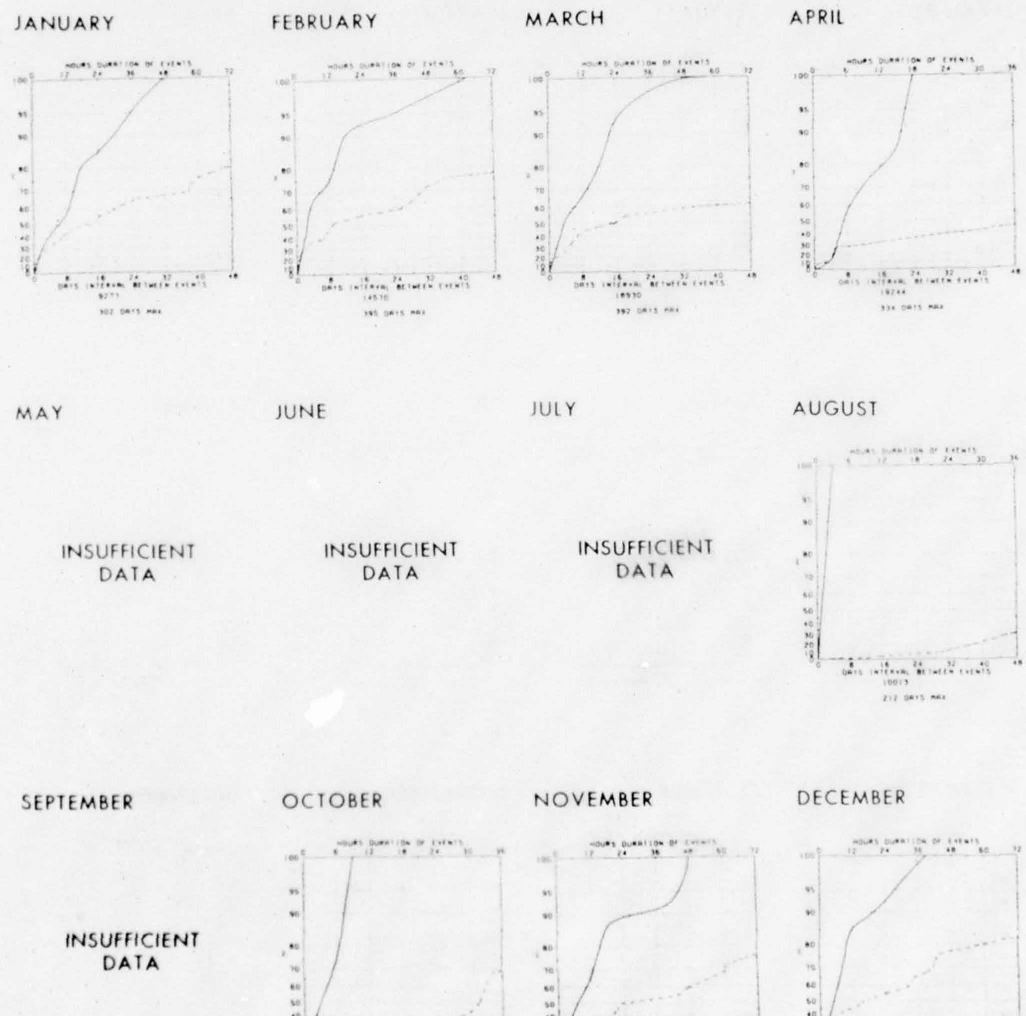


Figure 43. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ⩾ 5-meter wave event and of days interval between events for OWS N. (Reproduced from Naval Weather Service, Ref. 27).

Durations of events meeting the above criterion are depicted by SOLID lines and refer to the TOP SCALE of each graph.

Intervals between events are depicted by DASHED lines and refer to the BOTTOM SCALE of each graph.

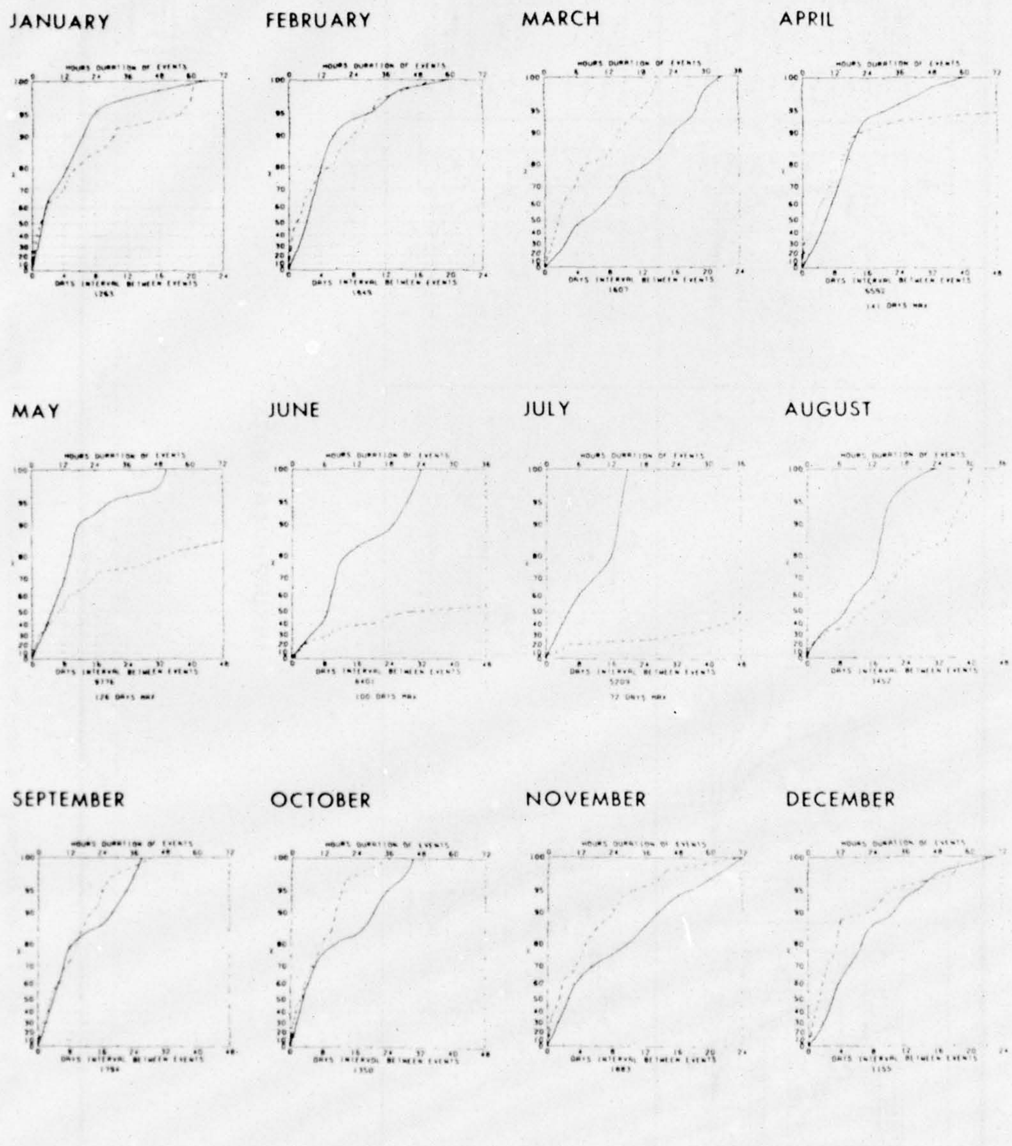


Figure 44. Monthly persistence graphs giving the cumulative percent frequency of hours of duration of a ≥ 5-meter wave event and of days interval between events for OWS P. (Reproduced from Naval Weather Service, Ref. 27).

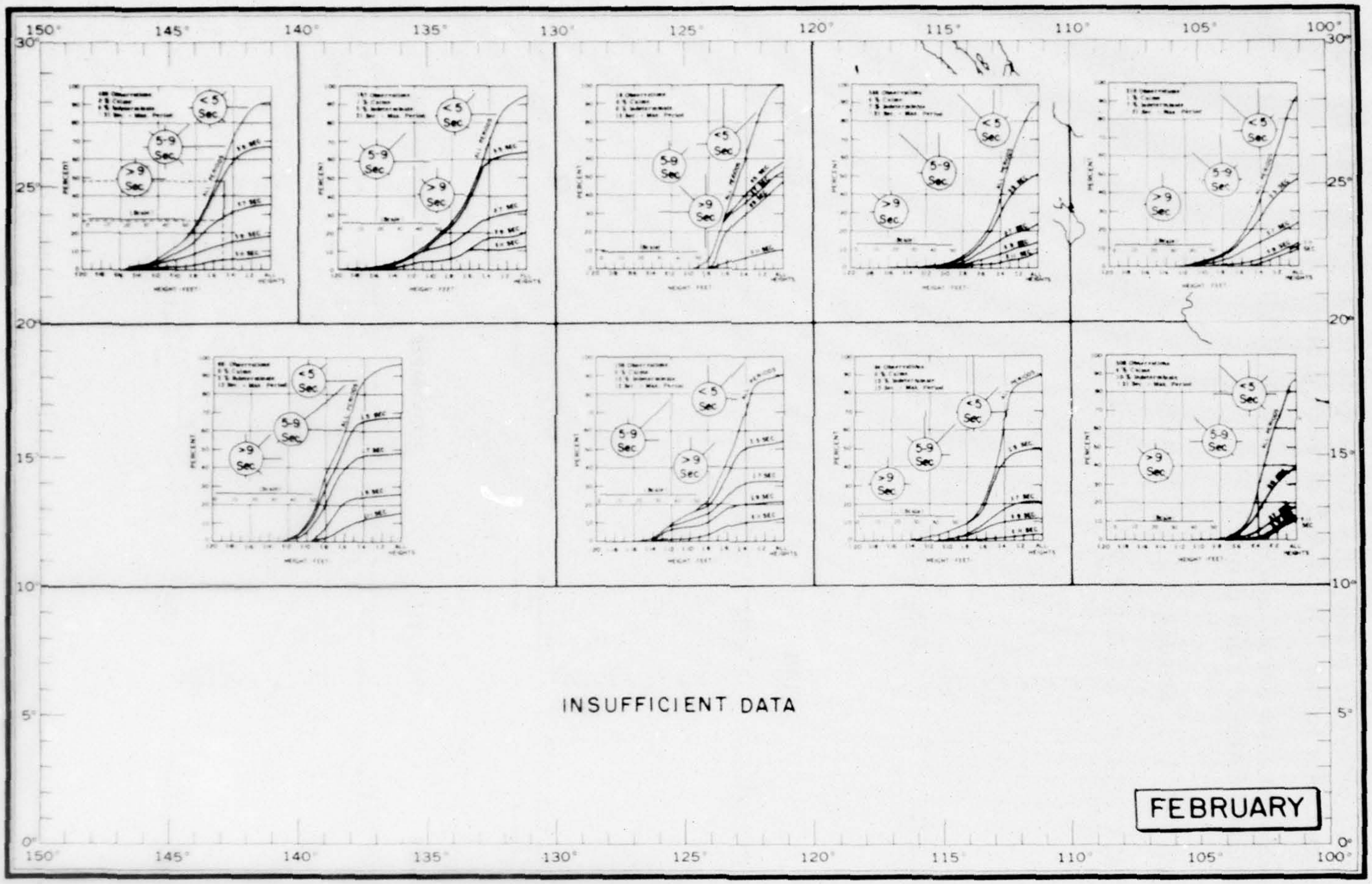


Figure 45. Percent frequency of wave height, period and direction for February for southern portion of survey area south of 30°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

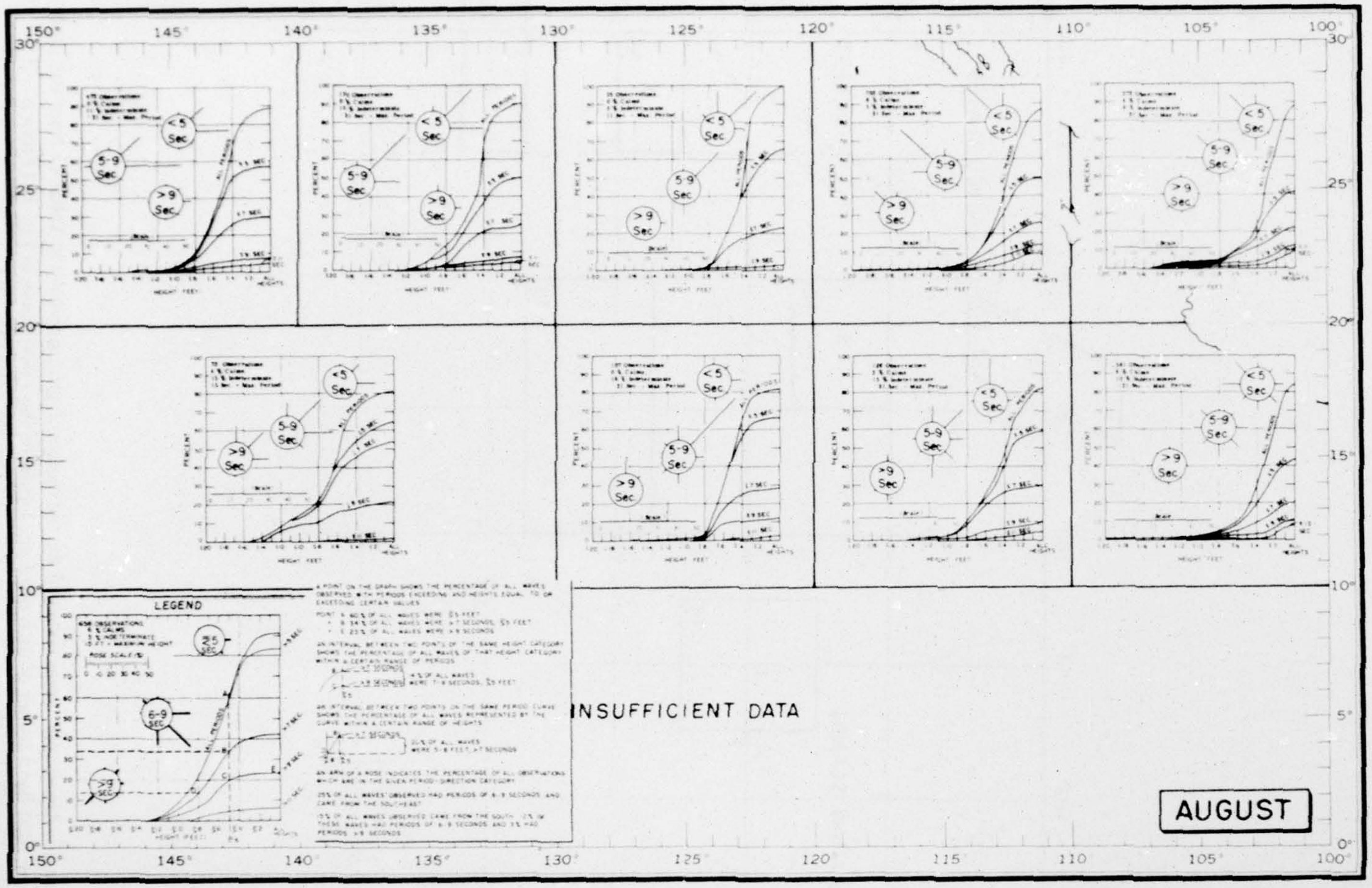


Figure 46. Percent frequency of wave height, period and direction for August for southern portion of the survey area south of 30°N. (1 foot ≈ 0.3 meter) (From U.S. Navy sources).

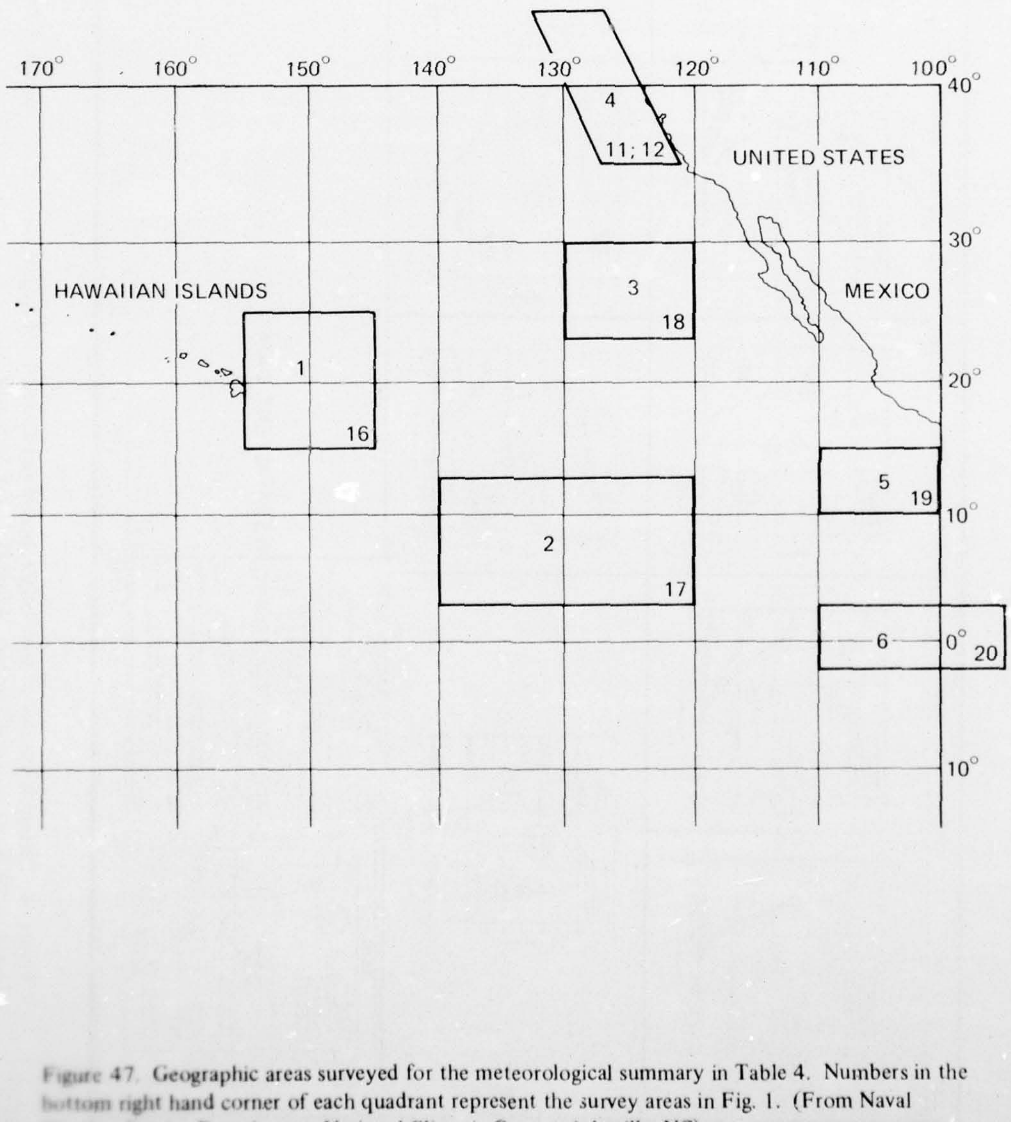
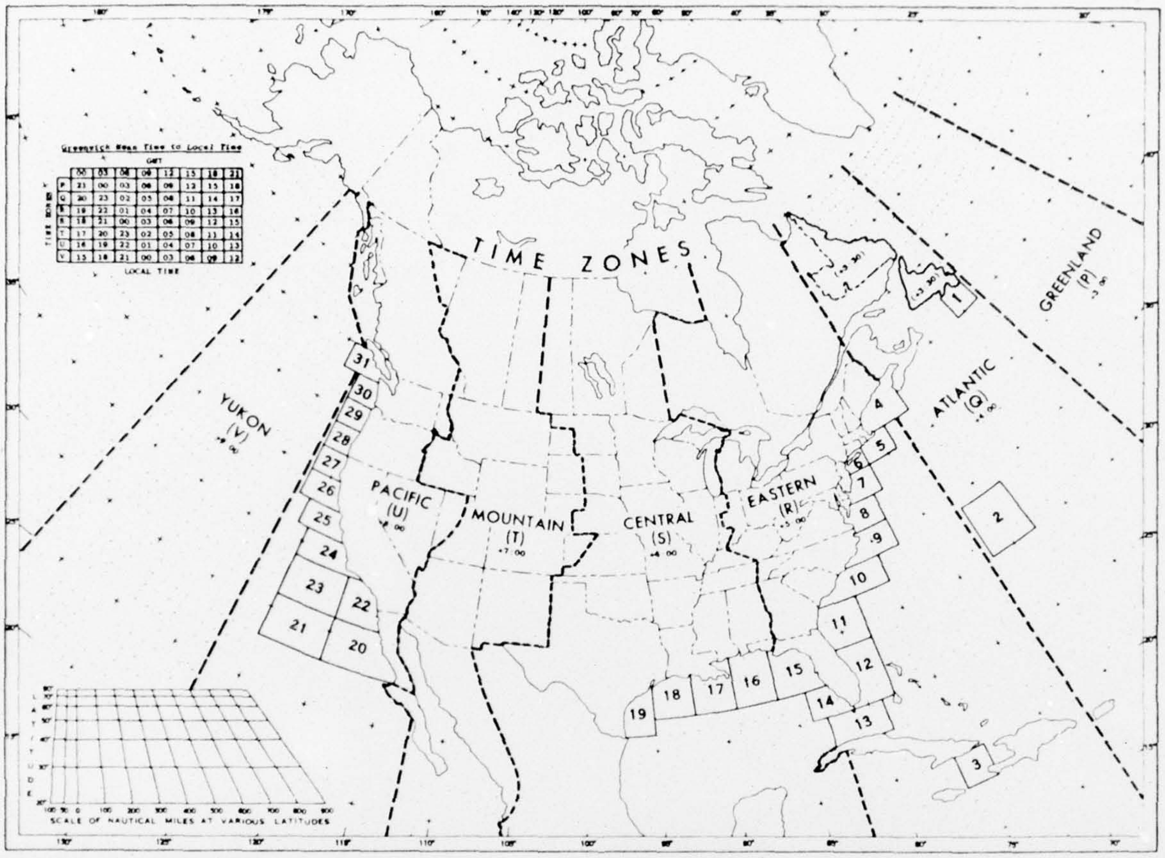
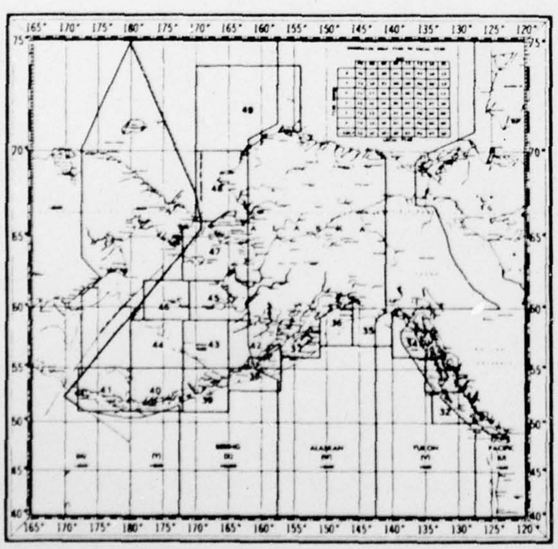


Figure 47. Geographic areas surveyed for the meteorological summary in Table 4. Numbers in the bottom right hand corner of each quadrant represent the survey areas in Fig. 1. (From Naval Weather Service Detachment, National Climatic Center, Asheville, NC).





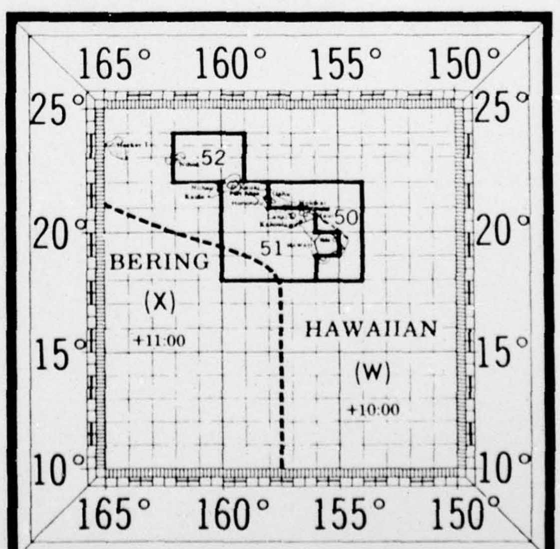


Figure 48. Maps showing coastal areas for which wind and wave recurrence statistics (Table 5) were computed. (Reproduced from NOAA, Ref. 38).

PRELIMINARY OFEF SITE SELECTION

Before specific site selections are made, certain areas can be omitted because their environmental characteristics are completely outside the preliminary selection criteria. The following discussion will tentatively support or reject certain areas as potential farm sites for Phase 1; additionally, some discussion of site potentials for future phases will be given.

BIOLOGICAL CRITERIA

Temperature

Utilizing 20°C as the temperature maximum for Macrocystis tolerance and Fig. 11 as a guide, it is apparent that south of about 31°N, cooling by upwelling will be required. The further south the site is located, the greater is the upwelling required to lower the ambient temperature to 20°C, except for the equatorial upwelling region where ambient surface temperatures are lower, thus reducing the requirement for upwelled water. From Figs. 1 and 11 plus Appendices B and C, it is apparent that areas 11 and 12 require no cooling from upwelling (the need for nutrients in these areas may, of course, impose requirements for upwelling). Areas 1-9 are marginal and may require slight cooling during the late summer. Areas 10, 15, and 18 would require some cooling during the summer months. Area 13 would require 2 to 3 degrees cooling during summer and fall. Assuming that the upwelled water was from 200 meters (13°C) and completely mixed, then approximately 33 percent upwelled water would be required in the surface layer to lower its ambient temperature to 20°C. Off Hawaii (areas 14 and 16), approximately 50 percent of the surface water would have to be upwelled from 200 meters to meet the temperature requirement. Also, in areas 17 and 19 in the tropical eastern Pacific north of the equator, the surface waters would have to be mixed with approximately 50-percent upwelled water from 200 meters to lower ambient temperatures to 20°C. In area 20, the winter and spring seasons are the warmest (25°C), thus requiring approximately 40-percent upwelled water mixed with ambient surface water to lower the temperature to 20°C.

The 20°C temperature limitation has not been conclusively demonstrated, and the actual limiting temperature may be significantly higher, thus possibly requiring less upwelling for cooling purposes. If, however, 20°C is assumed to be limiting, then north of 30°N there appears to be little or no problem from upper temperature limitations whereas south to about 25°N some cooling will be required. Off Hawaii and between 25°N and the equator, surface temperatures may be limiting unless enough deep water (200-meter) can be brought to the surface to produce a 50 percent deep/50 percent surface water mixture.

Nutrients

Macrocystis nitrate requirements are tentatively placed at 3 to 5 μg-at/liter minimum, and 10-15 μg-at/liter optimal. The only areas where the required nitrate concentrations are observed at the surface are the near-coastal zones during the upwelling seasons and in the

equatorial and Costa Rica Dome upwelling regions (Fig. 1). At all other offshore areas, artificial upwelling will be required. To provide adequate nutrients to the plants, using a reasonable upwelling volume, the upwelled water may need to contain some 20 to 30 μg-at NO_3/liter. In general, nutrient concentrations in the 20 to 30 μg-at/liter range are found at deeper depths as one moves west from the coast and from north to south. The depth of the 30 μg-at/liter NO_3 level increases from 100-200 meters at 40-45°N to 250-350 meters at 25-30°N along the west coast, and is at 350-500 meters off Hawaii. Other things being equal, the greater the depth from which water must be pumped, the greater the costs involved. The proposed pumping depth of 100 meters (Ref. 2) for a Phase 3 farm might necessitate locating the farm above 40°N or very close to west coast upwelling areas within a few kilometers from shore, or else pumping rates could possibly be increased somewhat beyond the proposed five acre feet (six cubic kilometers) per day (Ref. 2). Upwelling pipes might have to be 200-300 meters long off southern California in open ocean areas, and even longer to the south or west to provide adequate concentrations of nutrients to the surface. In the equatorial upwelling and Costa Rica Dome regions, it is possible that no artificial upwelling would be needed because of the continual high concentration of nutrients at the surface. Other factors, however, place these upwelling regions in doubt as potential farm locations for the near term because of the relatively high current speed, temperature regime, and remoteness from potential processing facilities. If, however, the OFEF concept of a dynamically-positioned farm capable of movement with propulsors (Refs. 2 and 3) is tenable, and at-sea processing and long-distance transportation become economically feasible, then large floating farms in the equatorial region become a strong possibility. The farms could float to the east with the Equatorial Countercurrent, move south a few hundred kilometers and move west with the South Equatorial Current, and then propulse north to the Equatorial Countercurrent again, thus remaining in a limited area of the central eastern Pacific and within high-nutrient waters.

The requirement for nutrients at a given concentration may be a significant economic factor because the costs increase with the depth of the required upwelling and the depth of derived nutrient levels varies with area. Therefore, location of the OFEF with regard to nutrients is more a question of economics than of Macrocystis requirements. Probably the most cost effective farm locations from the nutrient (near surface) availability standpoint would be as follows:

1. Equatorial Upwelling Zone (area 20), Costa Rica Dome, and Peruvian upwelling regions;
2. Areas north of 40°N and coastal regions to 35°N (area 12);
3. Coastal regions south of 35°N to 25°N (areas 11 and 1-9);
4. Areas 10 and 18; and the
5. Central eastern Pacific areas 13, 14, 15, 16, 17 and 19.

Practically, for Phase 1 and 2 farms and early Phase 3 farms, the areas included under 2 and 3 above are the most feasible from a nutrient viewpoint.

Currents

Phase 1 and 2 farms will probably be moored and therefore the surface currents could be a major contributor to the water movement around the plants. Current speeds greater than the minimum (4 cm/sec) requirements are observed almost continually throughout the eastern Pacific survey area. Current speeds less than the optimal (10 cm/sec) can occur in the north Pacific gyral area, 25° to 45°N and 130° to 160°W, and in the southern extreme of the California Current, 20° to 25°N. Because of the tendency of the plants to deflect toward the horizontal in currents of greater than 25 cm/sec, sustained currents of greater than this speed may have to be avoided, at least for the relatively small Phase 1 and 2 moored systems.* Areas where currents greater than 25 cm/sec are observed for significant periods of time, include the northern Davidson Current during the winter and the Alaska Current to the north. Also, the North Equatorial Current, the Equatorial Countercurrent, and the South Equatorial Currents exhibit speeds greater than 25 cm/sec much of the time between 5°S and 15°N from the coast to the western edge of the survey area.

Areas which meet the optimal current ranges (10 to 25 cm/sec) include the westward-moving North Pacific and Subarctic Currents, 35° to 42°N; most of the California Current region south of 40°N; the northern portion of the North Equatorial Current region from the coast westward between 15° and 20°N; and the South and Central American coastal areas from the equator to central Mexico (20°N).

With the advent of floating OFEF's, current velocities above 25 cm/sec may become less restrictive because the farms can float with the currents, thus reducing the relative water motion. In floating farms, the importance of wind mixing, internal waves, and upwelling velocity is increased while the importance of surface current velocity is decreased in relation to nutrient uptake rates. However, the energy requirements and engineering limitations for station-keeping must be considered as well.

ENGINEERING CRITERIA

Currents

Although current engineering limitations are not yet well defined, design requirements which meet certain minimal environmental forces will have to be met. A 50-cm/sec operational current is assumed for developmental design of the substrate structure (Ref. 17). A 1.5-m/sec sustained current is the initial engineering design limitation value. Both the operational and design currents are above the biological sustained current limitation of 25 cm/sec. In terms of engineering current limitations, the only areas which have sustained currents above 50 cm/sec are the South Equatorial Current and the northeastern portion of the survey area near Vancouver Island (Fig. 7). Currents of 100 cm/sec are observed in the California and Davidson Currents under extreme conditions (Figs. 5 and 6, these measurements are from ship drift and may be somewhat elevated). Storm-generated currents may, however, become highly important in terms of plant and structural survival (see Appendix E).

**Ambient currents will probably not penetrate far into large OFEF's, see Ref. 16.*

Storms/Wind

It will be best for the early OFEF's to avoid areas of strong storms because of the high waves and surface currents generated by them. If possible, areas of storm-force winds ($\geq$ 25 m/sec) and hurricane-force winds ($\geq$ 33 m/sec) should be avoided, and encounters with gale-force winds ($\geq$ 17 m/sec) should be minimized. In the north, extratropical cyclones are generated in the Gulf of Alaska, and these frequently move toward the south with diminishing intensity and frequency to a maximum southern limit of about 30°N. Subtropical cyclones move from an area of generation near 15°N to the west and northwest with diminishing intensity to about 35°N (maximum northern limit of tropical storms). North of about 35°N, and particularly to the northwest, storms and high-wind velocities are common. In the south, between 10°N and 30°N, and to the west to 160°W the probability of strong subtropical storms and hurricanes is high, and these areas should initially be avoided. Areas of low-velocity winds with low probability of intense storms (the most desirable for OFEF location) are given below in order of preference.

1. Southern California and northern Baja California between 35°N and 30°N within 97 kilometers of the coast, (areas 1 through 9 and the northern portion of 10). This area has the lowest probability of extreme winds of any coastal area in the United States (approximately 1 storm $\geq$ 25 m/sec in a 5-year period).

2. 25°N to 32°N, 120°W to 140°W (areas 15 and 18).

3. Leeward side of Hawaiian Islands (area 51, Fig. 48).

4. Trade wind regions south of tropical cyclone areas, 10°N to 10°S from the coast, west to 160°W. (Relatively constant winds of 5-10 m/sec.)

Waves

Wind-generated waves are relatively constant throughout the survey area. The mean wave height is between 1 and 1.5 meters in all areas (Table 4); however, 99.5 percentile and extreme waves are highly variable. North of 35°N, both along the coast and to the west, 5-year significant and extreme waves are higher than the proposed engineering limitations for preliminary farms (11 and 19 meters, respectively). Areas to the south, particularly the coastal regions from 34°N to 27°N and west to 125°W (areas 1 through 10 and the eastern half of 18, Fig. 1) and regions 20 to 23 (Table 5), show very low wave heights and 10-year extremes within the designated criteria. South of this area, to about 10°N, tropical cyclones can cause very high waves which in conjunction with high currents might cause structural or plant damage to an OFEF located in this area. Wave heights increase in a westerly direction. OWS N (30°N, 140°W) is marginal, with an estimated 5-year significant wave height of 11 meters (Table 6). North of OWS N waves become significantly higher, making this region less desirable as an OFEF site. In Hawaiian waters, extreme wave heights on the windward side of the islands are estimated to be significantly higher than on the leeward side (area 51, Table 5). The leeward side is within the engineering wave height limitations for 10-year waves, while the windward (north and east) side is not.

The southern California/northern Baja region is the area of least severe wind-generated waves.

ECONOMIC AND GEOPOLITICAL CONSIDERATIONS

Economic considerations are discussed in detail in Ref. 2 and are certainly of major importance in OFEF site selection. For Phase 1 experimental farms, the factors of production and transport costs are not a consideration. However, because these early prototype farms will have limited budgets and will be designed essentially to prove the OFEF concept, it is important that they be located in reasonable proximity to scientific and logistic support. Approximately 30 kilometers maximum (2-hour transit) is considered an appropriate distance for adequate scientific support and study of Phase 1 farms. This distance will limit the site initially to a near-shore (coast or island) location in the vicinity of a marine laboratory or facility. For large moored OFEF systems, the depth of the bottom is an important factor. For depths greater than 610 meters the mooring costs become excessive. This depth limitation is not highly significant for Phase 1 and 2 farms because of their small size (610-meter water is available) and relaxed economic requirements. For Phase 3 and the future, however, it is not likely that large farms can economically be anchored; they will probably be dynamically positioned and so will not be geographically limited by bottom contour.

OFEF should presently remain outside claimed territorial and economic zones of other countries until mutual international agreements are made. Currently most South and Central American countries and Mexico have claimed 200-mile (322-kilometer) economic or territorial zones, and it now appears certain that the U.S. will do the same by March 1977. Figure 1 gives the approximate 322-kilometer economic zone boundaries. With economic zone exclusion of the 322 kilometers around Guadalupe Island, the islands south of Baja California, and the Galapagos Islands, much of the open ocean areas as well as all the coastal regions south of 32°30'N are removed from OFEF site availability at the present time.

PHASE 1 SITE SELECTION

SOUTHERN CALIFORNIA OFEF SITE SELECTION

It is apparent that the first requirement for the Phase 1 OFEF prototype is that it should be located in the nearshore area to allow adequate access by scientific and support personnel. Secondly, it should be located in an area with mild oceanographic and meteorological characteristics and be within the criteria delineated in Table 1. The region best suited within the guidelines of the proposed and established criteria is the southern California offshore area from Pt. Conception, 34° 30′N, to the Mexican economic zone, 32° 30′N. This area is presented in Fig. 49, which also shows submarine transit lanes, shipping lanes, the 322-kilometer Mexican economic zone boundary and the proposed locations of selected OFEF Phase 1 sites listed in priority order.

The southern California offshore area has been selected as the optimal location for Phase 1, and will more than likely be selected for Phase 2 and early 3 as well, for the following reasons.

1. The sites chosen are within the U.S. economic zone which will be increased to 200 miles (322 kilometers) by March 1977, thereby avoiding possible international conflict.

2. The region has the most mild and least severe extreme weather conditions of any offshore area within the economic zone of the continental United States or Hawaii. It has a very low occurrence of high-velocity winds and high waves. This is because the region is north of the tropical cyclone zone and is located on the southern extreme of the extratropical cyclone region.

3. In this nearshore area, nutrients of adequate concentrations are relatively near the surface (15-25 μg-at/liter NO_3 at 100 meters).

4. Research and support facilities are available close to the proposed sites.

5. The region is within the natural habitat zone of Macrocystis pyrifera. Temperature and light regions are excellent for Macrocystis growth.

6. Current speeds are mostly within the ranges specified for optimal OFEF operations and kelp growth characteristics.

SOUTHERN CALIFORNIA OFFSHORE CHARACTERISTICS

Figures 50 through 71 (from the Naval Weather Service, Ref. 45) give detailed oceanographic and meteorologic data of the southern California offshore area. These data, along with the criteria below, were used to select specific sites. Table 8 gives nutrient concentrations for various depths off southern California and northern Baja California.

Winter (February) and summer (August) wave heights > 2 and > 6 feet (> 0.6 and 1.8 meters) are given in Figs. 50 and 51, and > 9 and > 12 feet (> 2.7 and 3.7 meters) in Figs. 52 and 53. Percent frequency of the wave heights given increase to the west showing a

minimal value of 20 percent for > 2-foot (0.6-meter) waves in August nearshore (Fig. 51) to a maximum of 70 percent for > 2-foot (0.6-meter) waves in the northern Channel Islands (34°N). High waves (> 3.7 meters) occur rarely in August (2.5 percent at about 121°W, 32°30'N) and are slightly more common in winter (Figs. 52 and 53).

Table 8. Nitrate concentration versus depth off southern California and northern Baja California.

Depth (m)	Ocean Locations 1	2	3	4	5	6	7	8	9	10	11
	Nitrate concentration (μg-at NO_3-N/liter)										
0	1	1	2	0.5	0.5	0.5	0	–	–	–	–
10	1	2	2	0.5	0.5	0.5	0	–	–	–	–
50	2	7	2	18.0	7.0	16.0	12	–	16	13	–
100	15	–	9	22.0	20.0	22.0	21	–	–	–	–
200	24	20	19	30.0	28.0	26.0	28	–	–	–	–
300	30	30	–	32.0	33.0	28.0	33	30	–	–	23-33

Ocean Locations	Data Sources
1. San Diego Trough – September 72	unpublished data
2. Off Baja California – July 72	unpublished 30°N, 120°W
3. Off Baja California – August 72	unpublished 30°N, 120°W
4. San Diego Trough – April 71	unpublished 32° 30'N, 117° 30'W
5. San Diego Trough – October 70	unpublished 32° 30'N, 117° 30'W
6. San Diego Trough – April 70	unpublished 32° 30'N, 117° 30'W
7. Santa Catalina Basin – May 65	33° 18.5'N, 118° 40'W (Ref. 46)
8. San Diego Trough – April 75	Supplied to W. North for upwelling experiments.
9. Catalina Island – September 75	W. North, Personal Comm.
10. Catalina Island – November 75	W. North, Personal Comm.

11. Range of values from 300 meters – ICC experiment, from W. North (Ref. 12)

Wind speeds are relatively low off southern California. Speeds of 6-11 m/sec during the summer (Fig. 57) occur between 10 and 20 percent of the time in the nearshore area and up to 40 percent of the time west of San Clemente Island. In winter, the frequencies of nearshore winds of 6-10 m/sec increase to 20 percent while those of offshore winds remain nearly the same. Winds of $\geqslant$ 18 m/sec are increasingly frequent in winter, occurring about 1 to 3 percent of the time off the Channel Islands and less than 0.5 percent in the nearshore areas (Fig. 54). Winds of $\leqslant$ 3 m/sec occur about 30 percent of the time in winter and summer in the Channel Island areas and about 50 to 60 percent of the time in the nearshore environment (33°-34°N).

The mixed layer* depth, given in Figs. 58 and 59, are relatively shallow in the nearshore areas and increase in a westerly direction. During summer the mixed depth is very shallow (about 6 meters) in the inshore areas; in winter this depth increases to 18 meters inshore, to about 24 meters off San Clemente Island, and to about 60 meters to the southwest (30°N, 120°W).

Figures 60 through 71 give monthly prevailing current direction and mean current speed. Currents south of 32° 30′N are generally south at 20 to 25 cm/sec. North of this, the currents are more variable in speed and direction. The prevailing nearshore currents are also 20 to 25 cm/sec. Currents in the Channel Island areas are more variable in direction including some westerly and northerly currents varying between 20 and 36 cm/sec on average. During fall and early winter the prevailing currents change to predominately a north to northwest direction (Davidson Current) with speed averaging 20 to 25 cm/sec. A high northwesterly current approximating 50 cm/sec off Santa Catalina is observed in December (Fig. 71). In January, near coastal currents are variable and in the spring the prevailing direction is south to southeast with speeds averaging from 20 to 30 cm/sec. Other current studies of the southern California area include CALCOFI, Ref. 47; Scripps Institute of Oceanography, Ref. 48; and the Oceanographic Survey of the Santa Barbara Channel Oil Spill, Ref. 49.

Specific Phase 1 site selections in the southern California area were made using the following criteria.

1. Locate within the 500-fathom (915-meter) contour to make mooring costs as economical as possible and still test the deep water OFEF concept.

2. Remain outside shipping and submarine transit lanes and common pleasure-boating areas.

3. Be within 32 kilometers (2-hour transit) of scientific and logistic support due to the frequent observation and measurement requirements of the Phase 1 farms.

**The layer in which wind-mixing occurs and below which the thermocline begins. The mixed layer is usually at a very low nutrient concentration due to phytoplanktonic utilization in this zone.*

PRIORITIZED PHASE 1 OFEF SITE SELECTION

The selected sites as shown in Fig. 49 were prioritized as stated below.

1. Site 1 is located in the inshore area south of Corona del Mar (33° 30′N, 117° 55′W). It was chosen as the first priority site because it is within 8 to 16 kilometers of the Cal Tech marine laboratory, thus allowing easy access to the early prototype experiments. The depth range is approximately 100-200 fathoms (180-360 meters) and the site is between the pleasure and commercial routes from Los Angeles to San Diego and points south. In addition, the inshore area has somewhat milder conditions than the offshore sites. Wave heights and wind velocities are reduced below those of the offshore islands (see Figs. 50-59). Also, the thermocline (bottom of the mixed layer) is frequently shallower at site 1 than at 2 and 3, making high-nutrient concentrations nearer to the surface (Fig. 54).

2. Site 2 is located 8 to 24 kilometers northwest of San Clemente Island (33° 05′N, 118° 45′W). This site was chosen because it is close to the Naval Undersea Center facility on the northern portion of San Clemente Island. An airstrip and small boats are available for farm support. This site would be an excellent location to test the deep water (away from coastal influence) concept of OFEF. In addition, this site would probably be less molested by private boats than the other two selections. A discussion of the near-surface nutrient regime is found in Ref. 10.

3. Site 3 is 5 to 15 kilometers northwest of Santa Catalina Island (33° 35′N, 118° 35′W). It is within 8 to 19 kilometers of the University of Southern California marine laboratory, shown in Fig. 49, which could function as a support facility for the farm project. The currents in this region can be somewhat higher than in other parts of the southern California area in winter (Fig. 69). A few nutrient measurements are given in Table 8. Site 3 is located just south of the shipping lane from Los Angeles to Hawaii and west of the major pleasure-boat traffic to Avalon Bay in the southern portion of Santa Catalina.

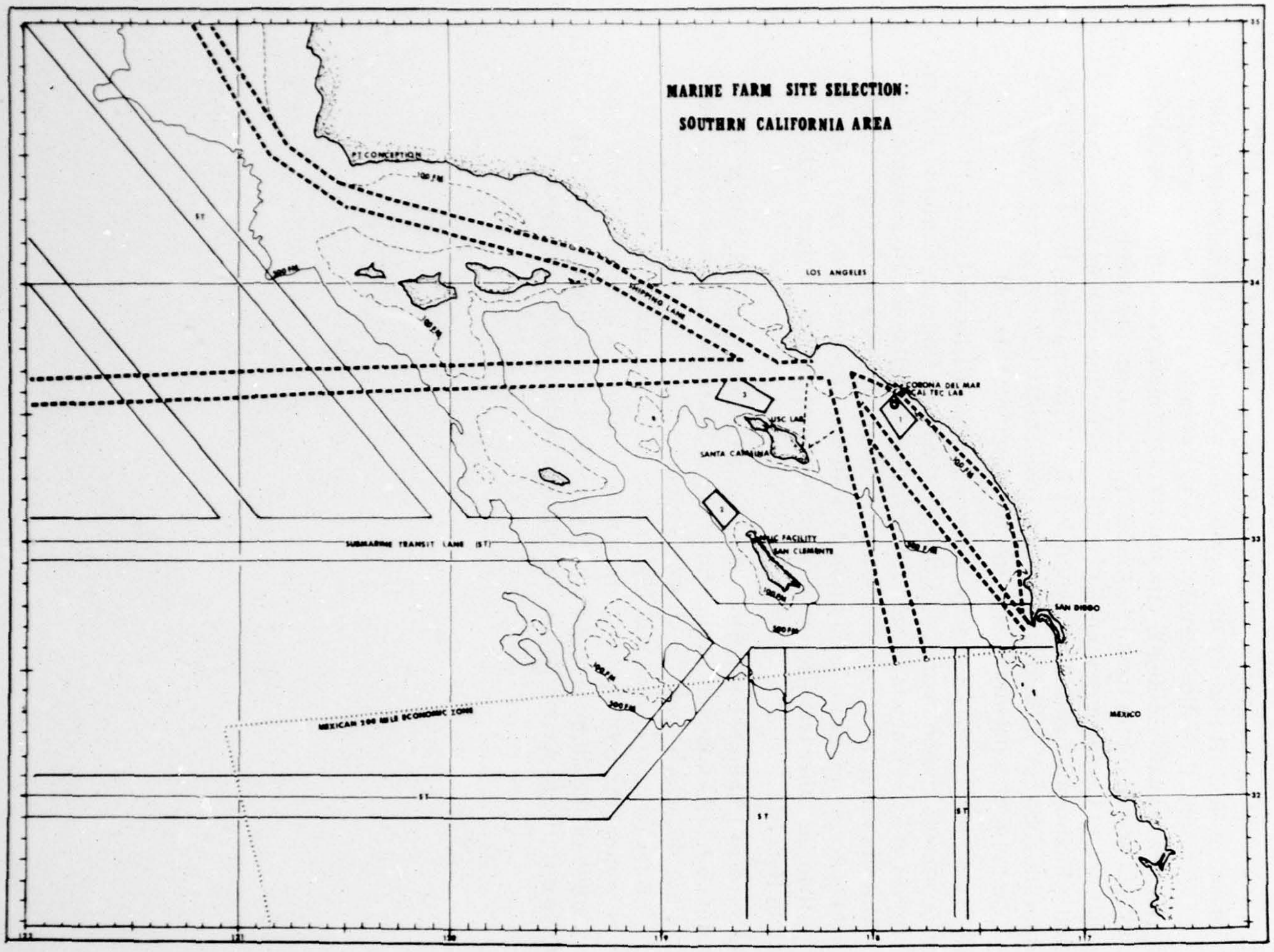


Figure 49. Phase 1 prioritized site selection, southern California area. Dashed lines give major commercial and pleasure craft shipping lanes, solid lines show submarine transit (ST) areas and dotted lines show approximate location of claimed Mexican 200 mile economic zone. Numbered quadrangles give selected locations for Phase 1 and possible Phase 2 farm sites in priority order. Star in area 1 was location of initial upwelling experiments (ICC) during January 1976. (200 miles ≈ 322 kilometers)

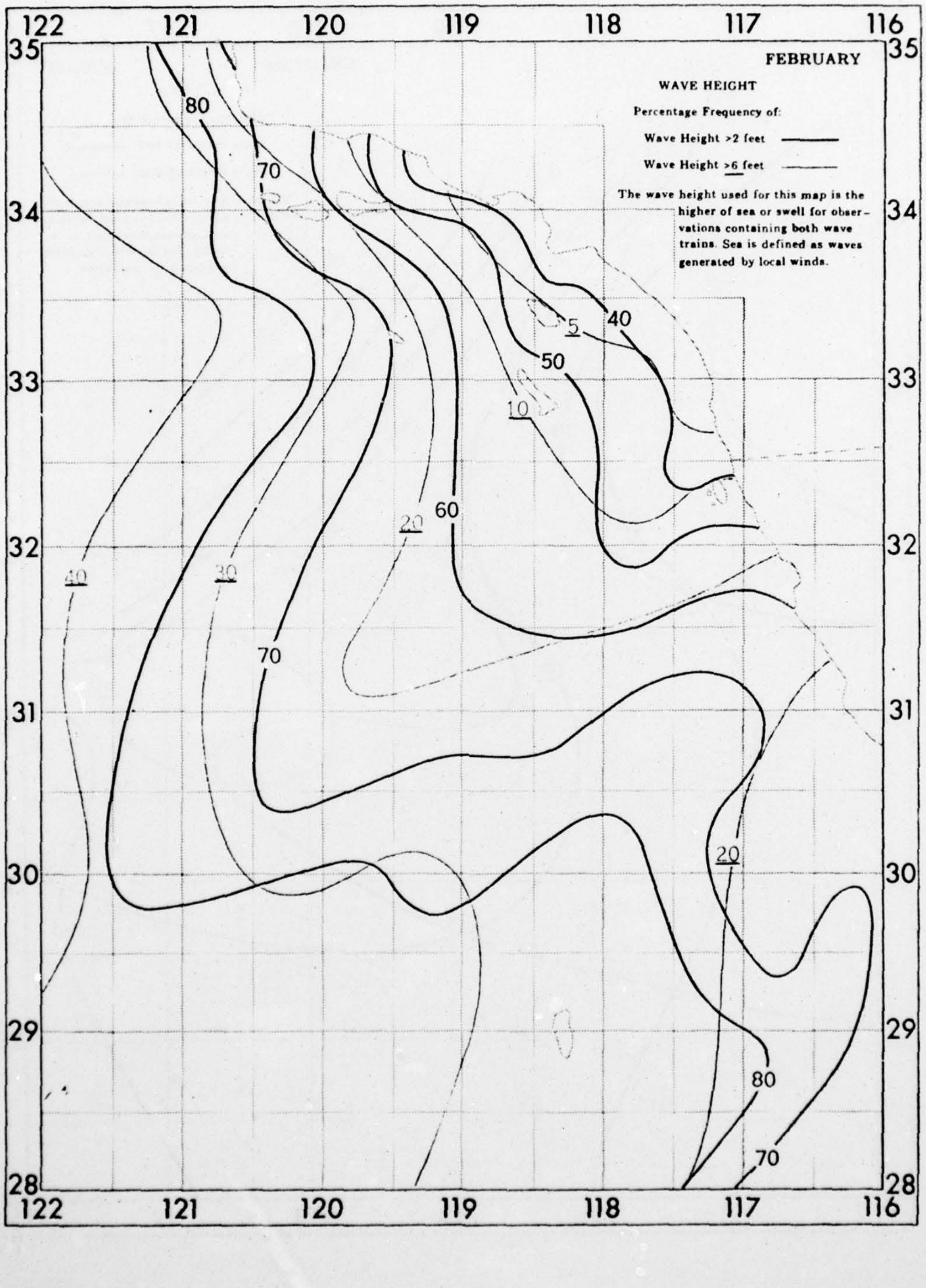


Figure 50. Percent frequency of wave height greater than 2 and 6 feet for the southern California area for February. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

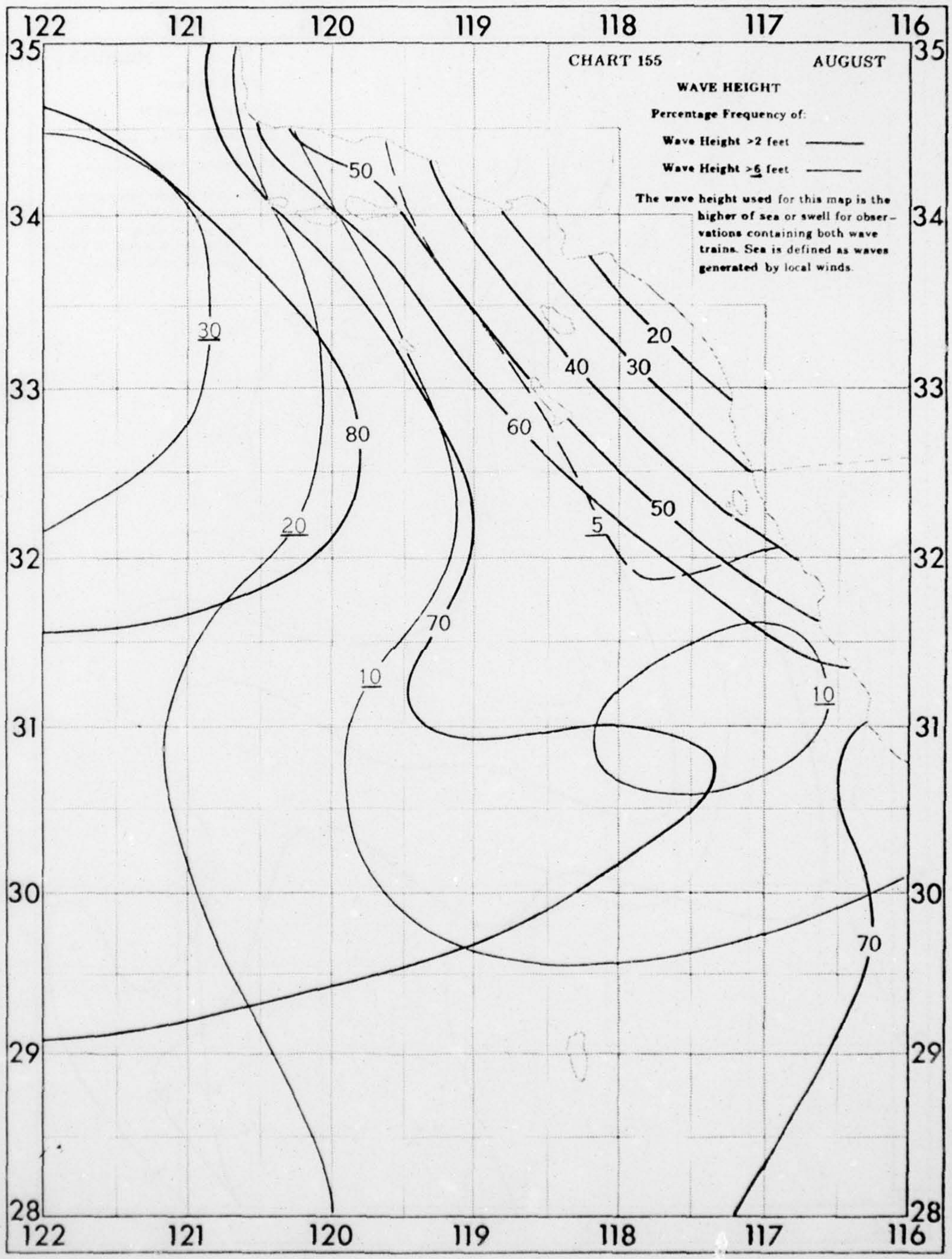


Figure 51. Percent frequency of wave height greater than 2 and 6 feet for the southern California area for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

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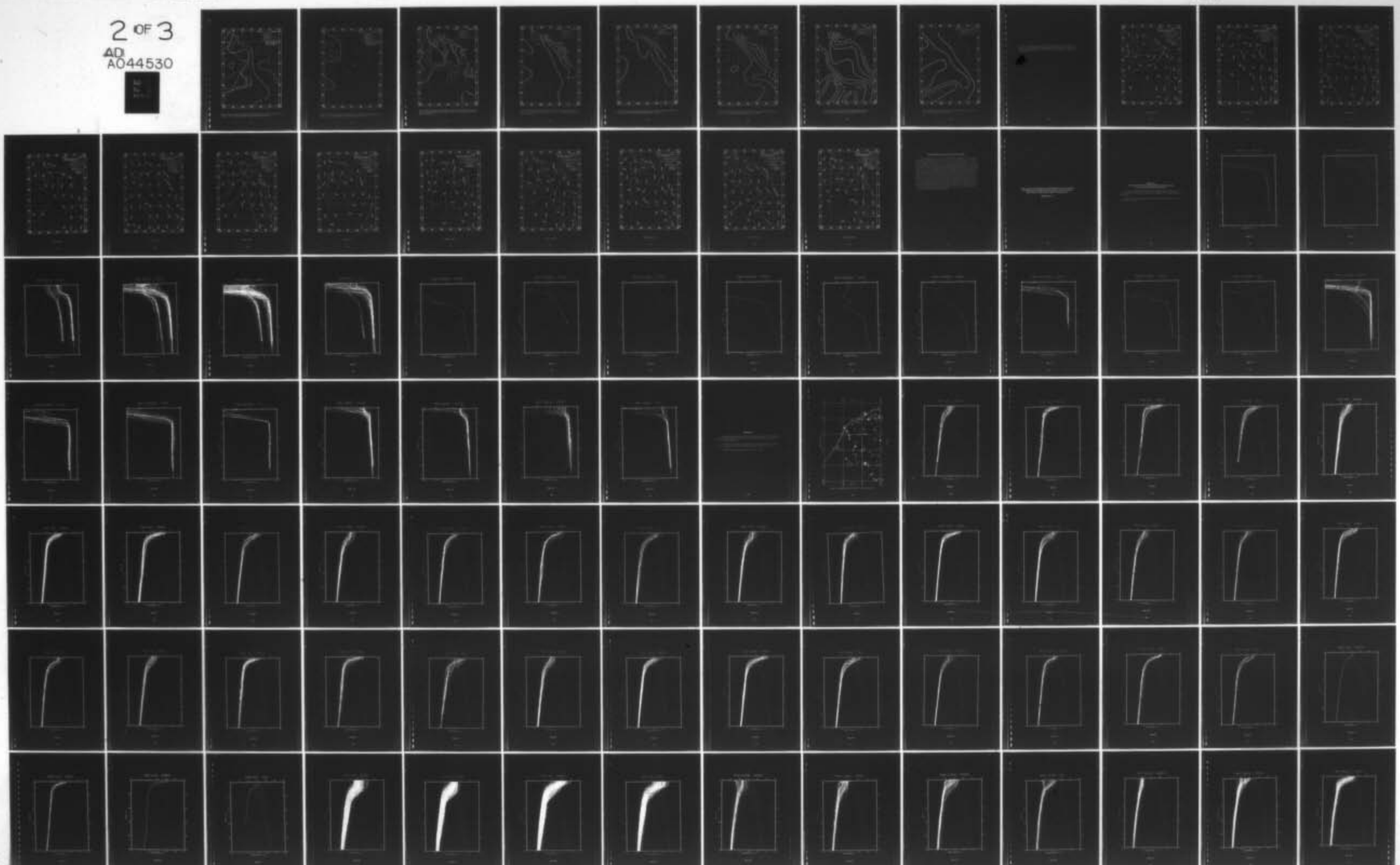


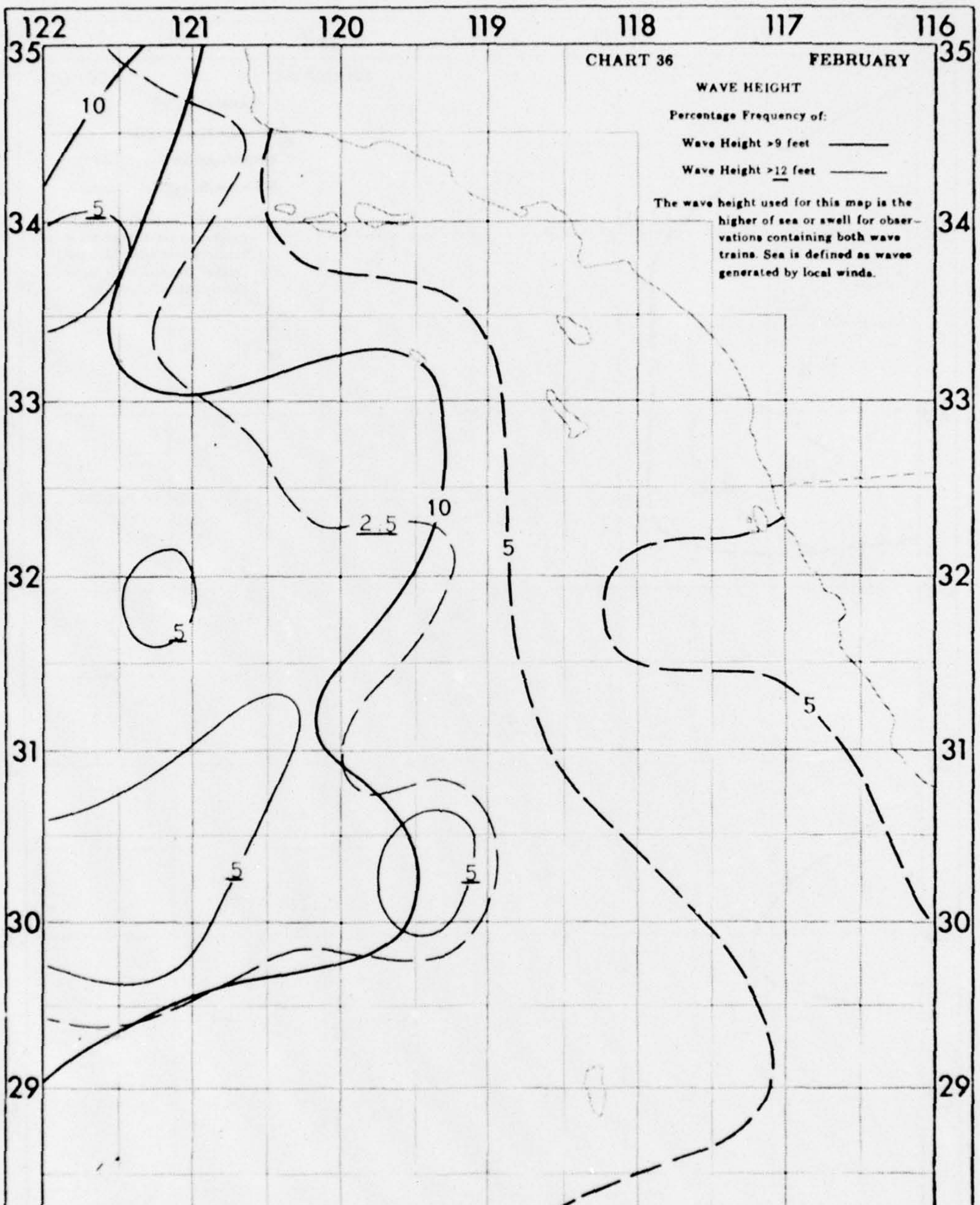


Figure 52. Percent frequency of wave height greater than 9 and 12 feet for the southern California area for February. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

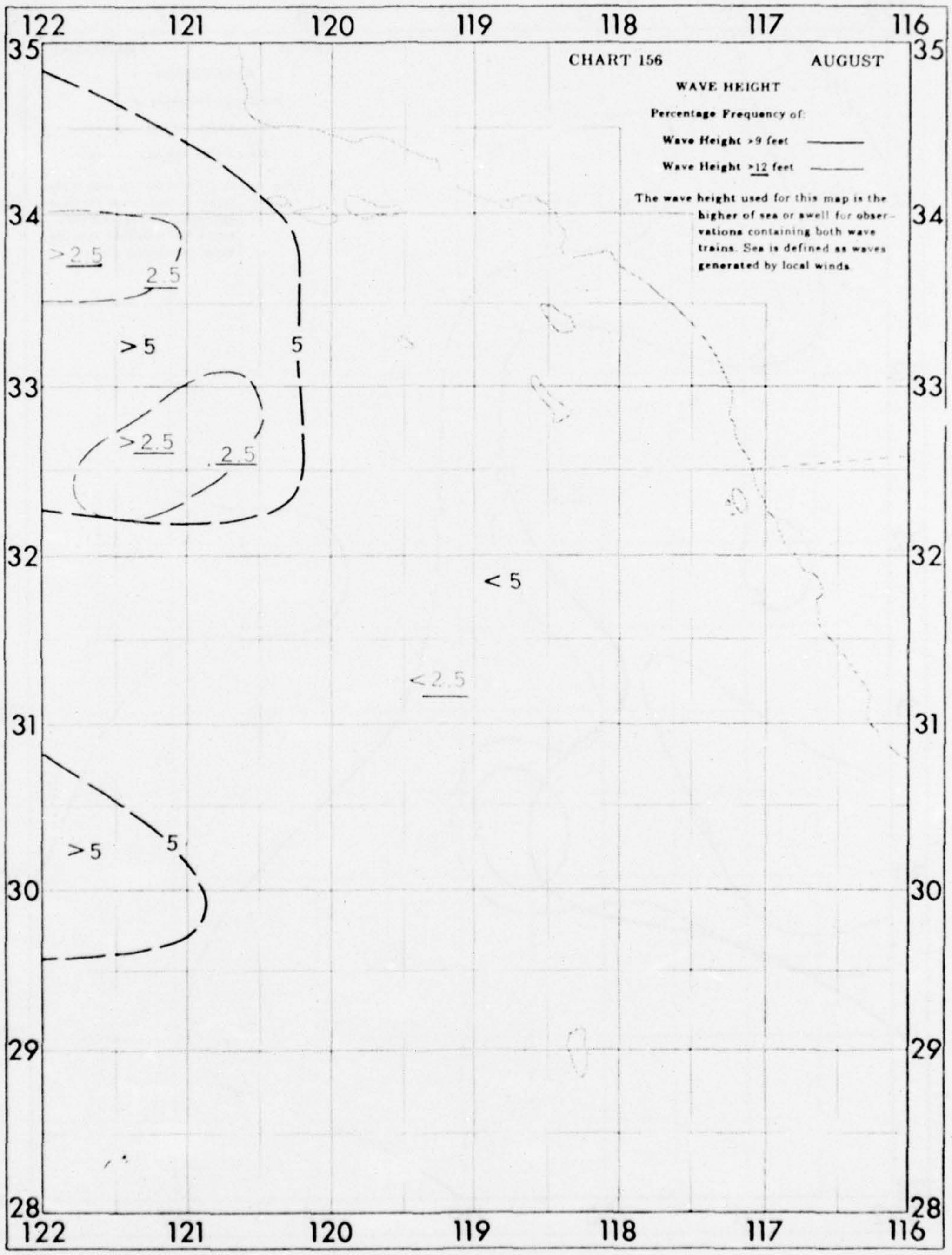


Figure 53. Percent frequency of wave height greater than 9 and 12 feet for the southern California area for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

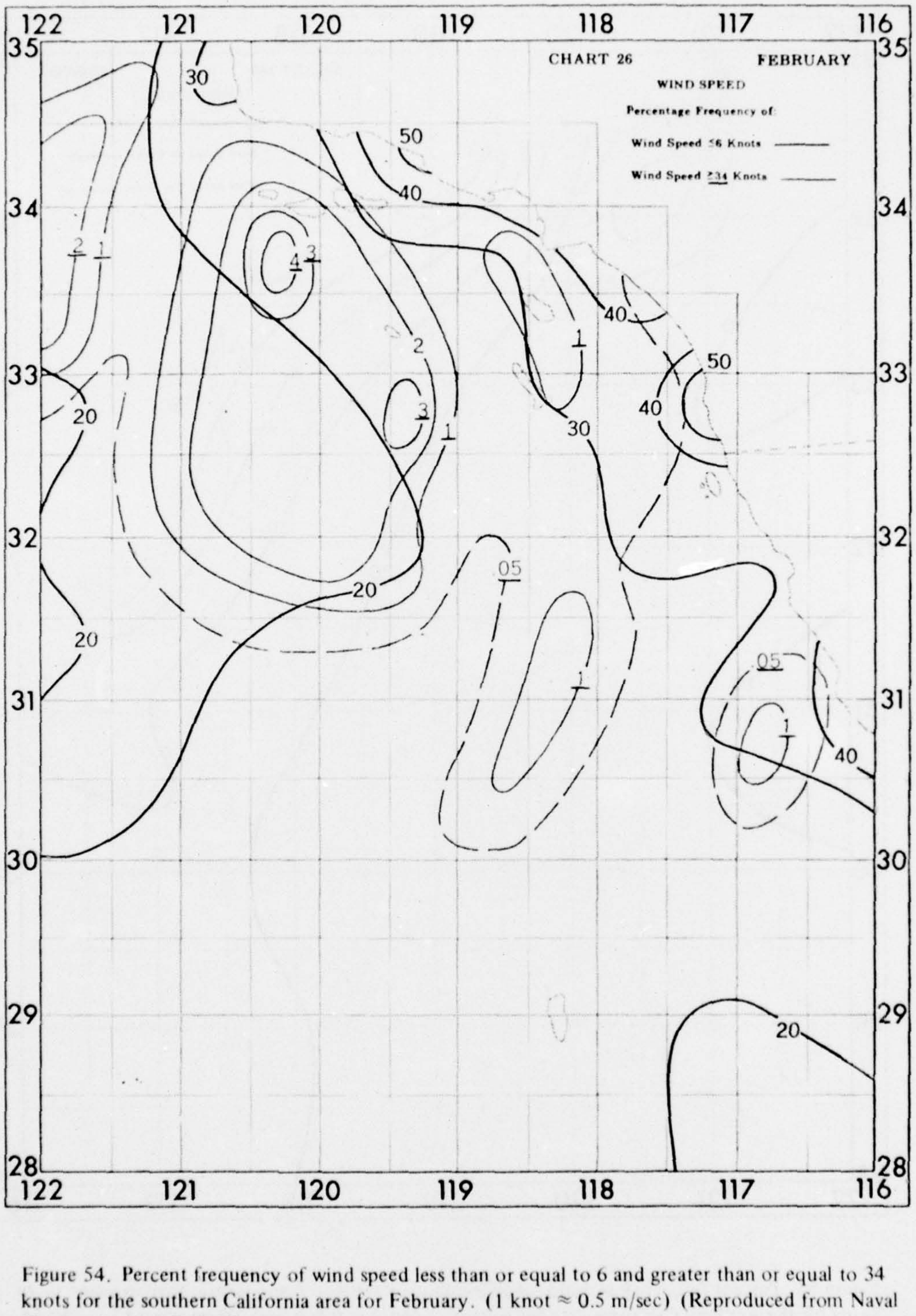


Figure 54. Percent frequency of wind speed less than or equal to 6 and greater than or equal to 34 knots for the southern California area for February. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

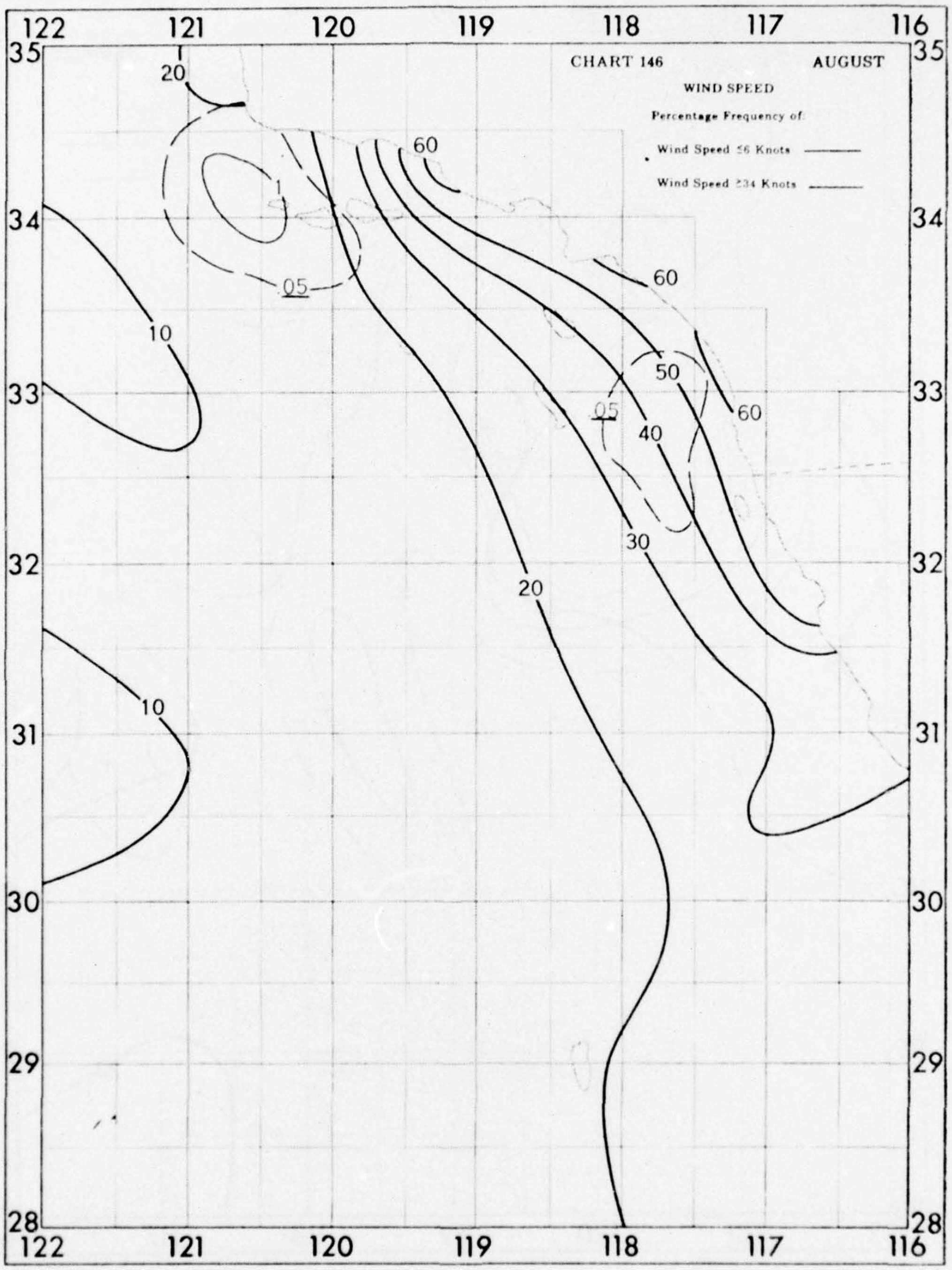


Figure 55. Percent frequency of wind speed less than or equal to 6 and greater than or equal to 34 knots for the southern California area for August. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

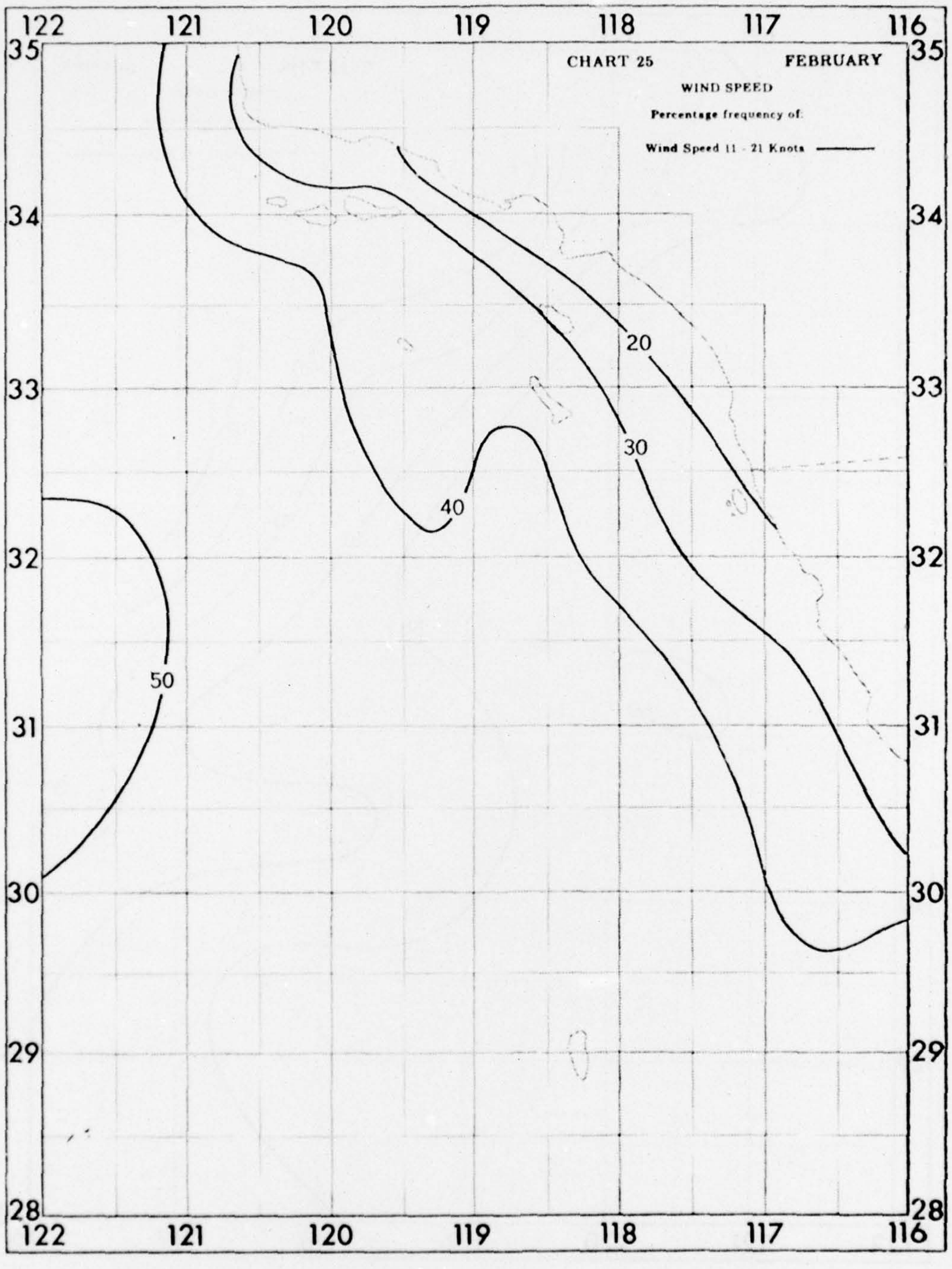


Figure 56. Percent frequency of wind speed 11-21 knots for the southern California area for February. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

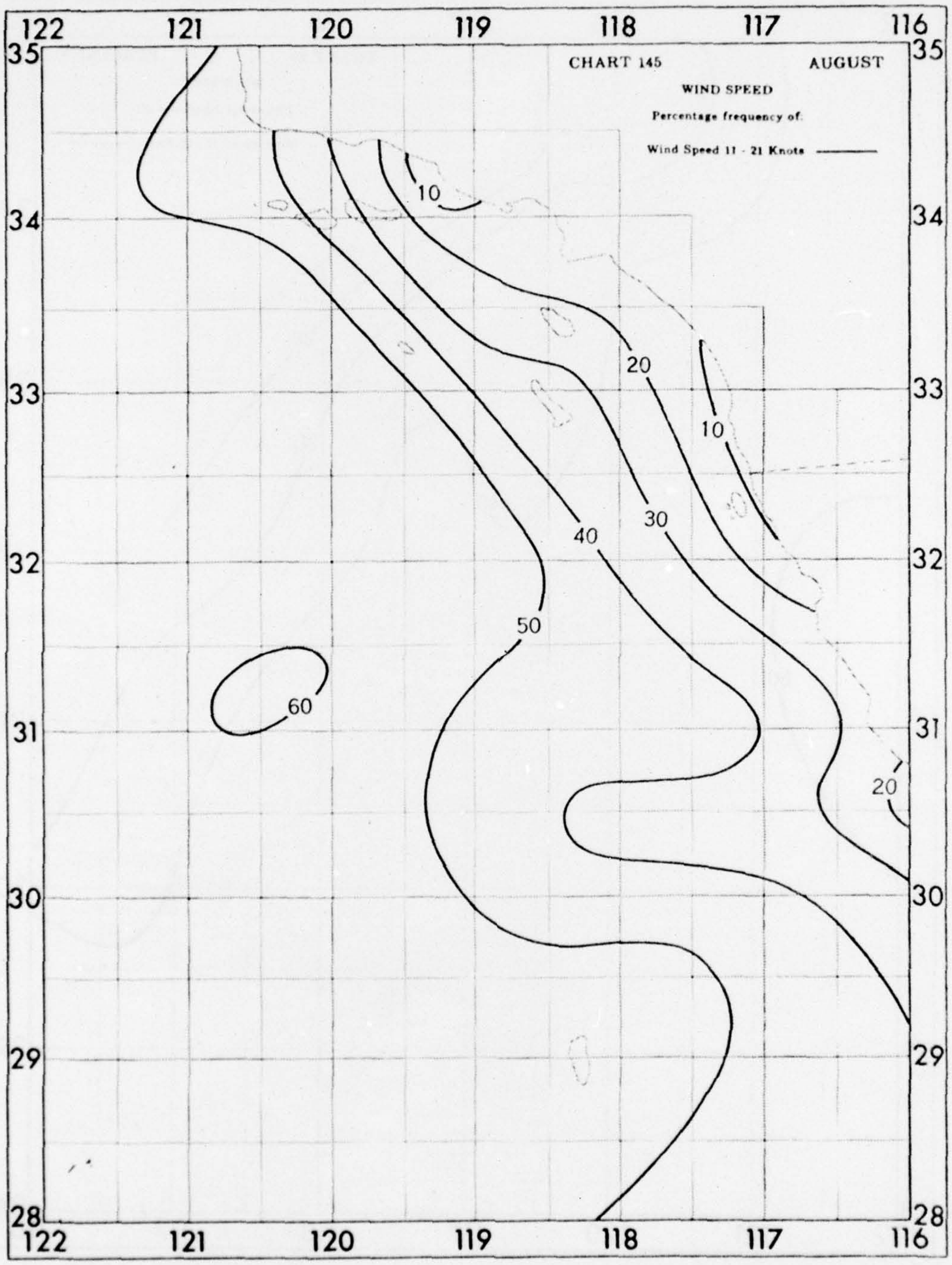


Figure 57. Percent frequency of wind speed 11-21 knots for the southern California area for August. (1 knot ≈ 0.5 m/sec) (Reproduced from Naval Weather Service, Ref. 45)

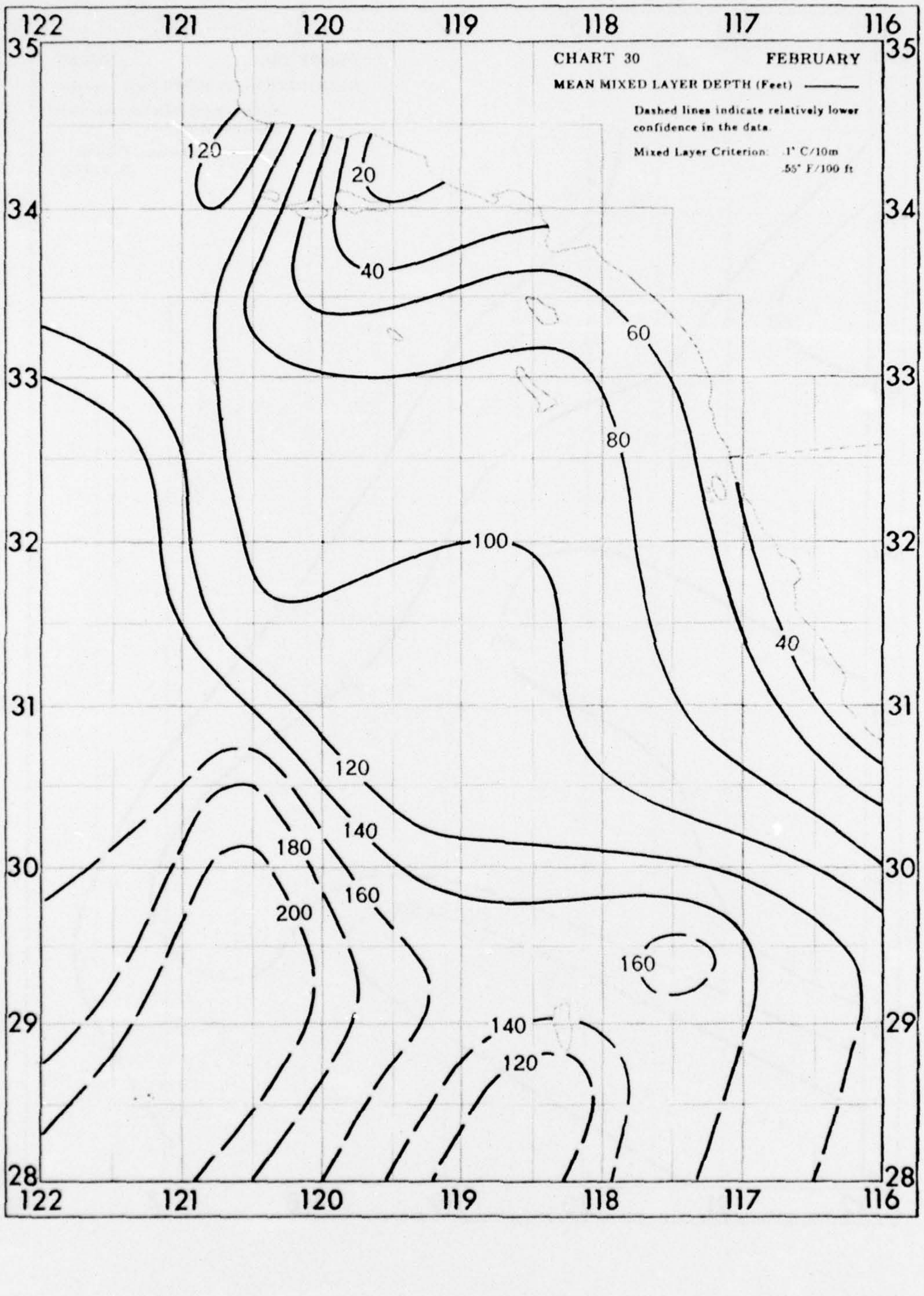


Figure 58. Depth of mean mixed layer off southern California for February. (1 *foot* ≈ 0.3 *meter*) (Reproduced from Naval Weather Service, Ref. 45)

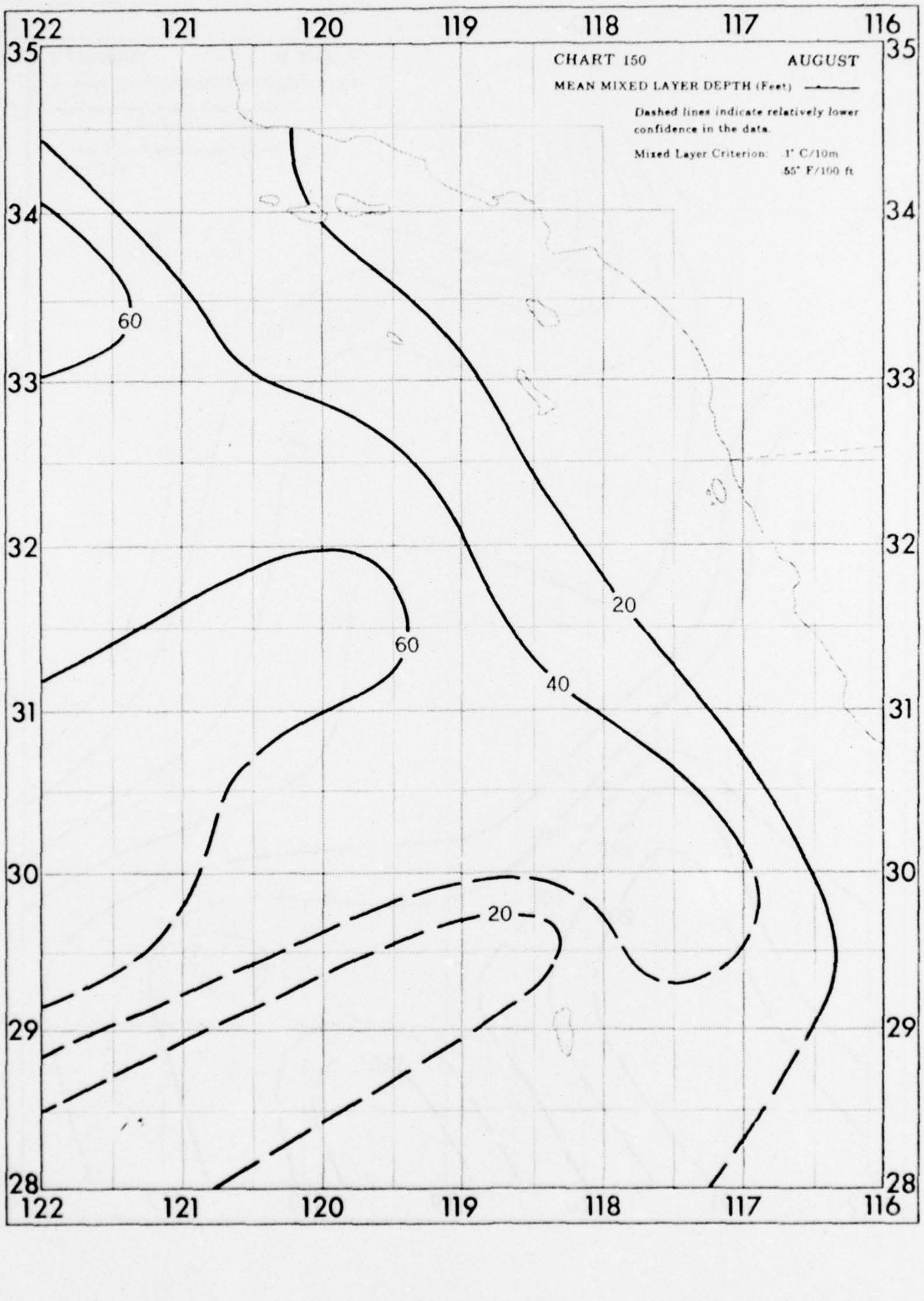


Figure 59. Depth of mean mixed layer off southern California for August. (1 foot ≈ 0.3 meter) (Reproduced from Naval Weather Service, Ref. 45)

Figures 60-71. Prevailing current direction and mean current speed for the southern California area. Secondary currents are indicated with dashed lines and variable currents with a V. Monthly data, January through December are given. (1 knot ≈ 0.5 m/sec) (Data reproduced from Naval Weather Service, Ref. 45)

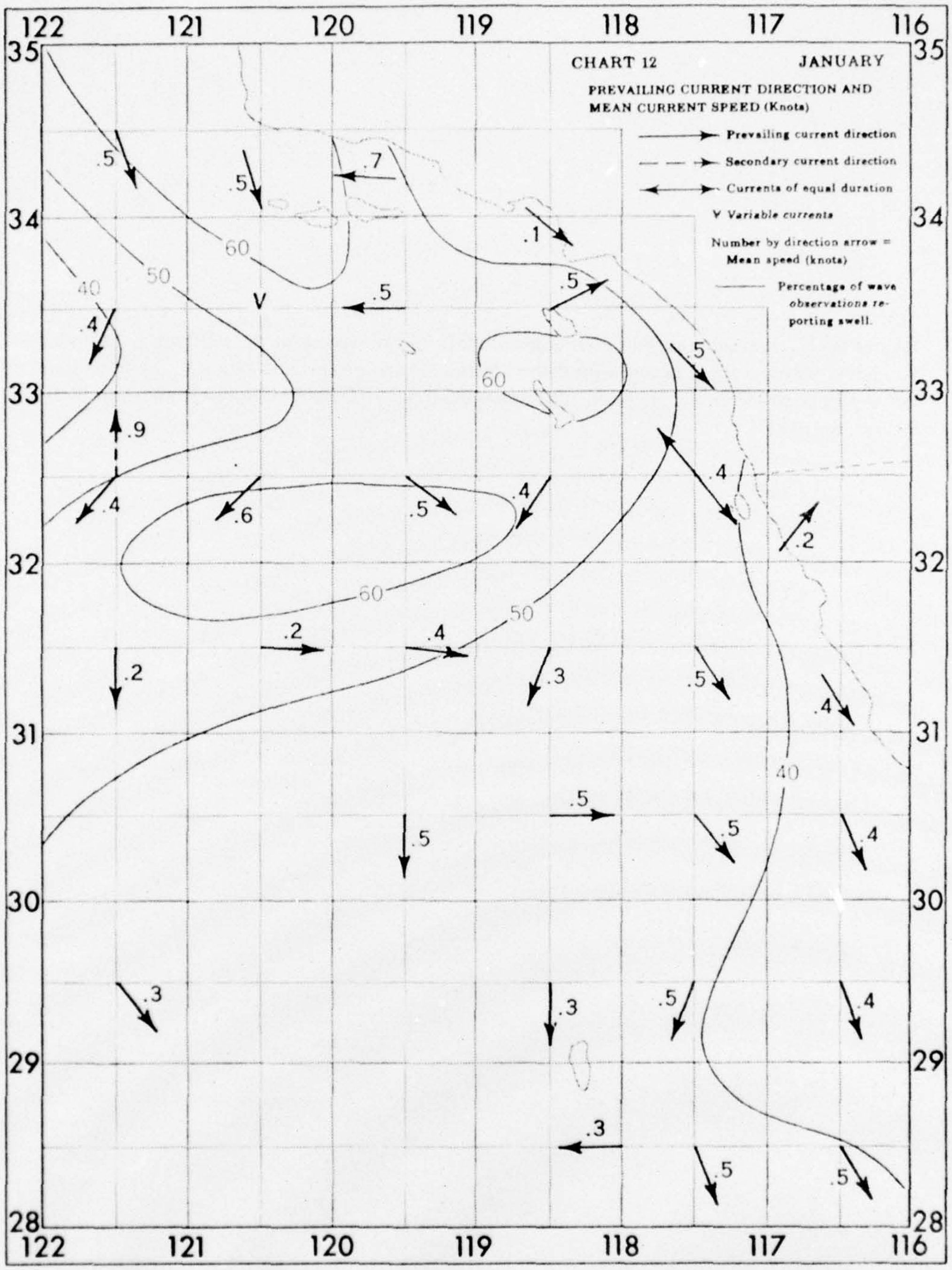


Figure 60. January

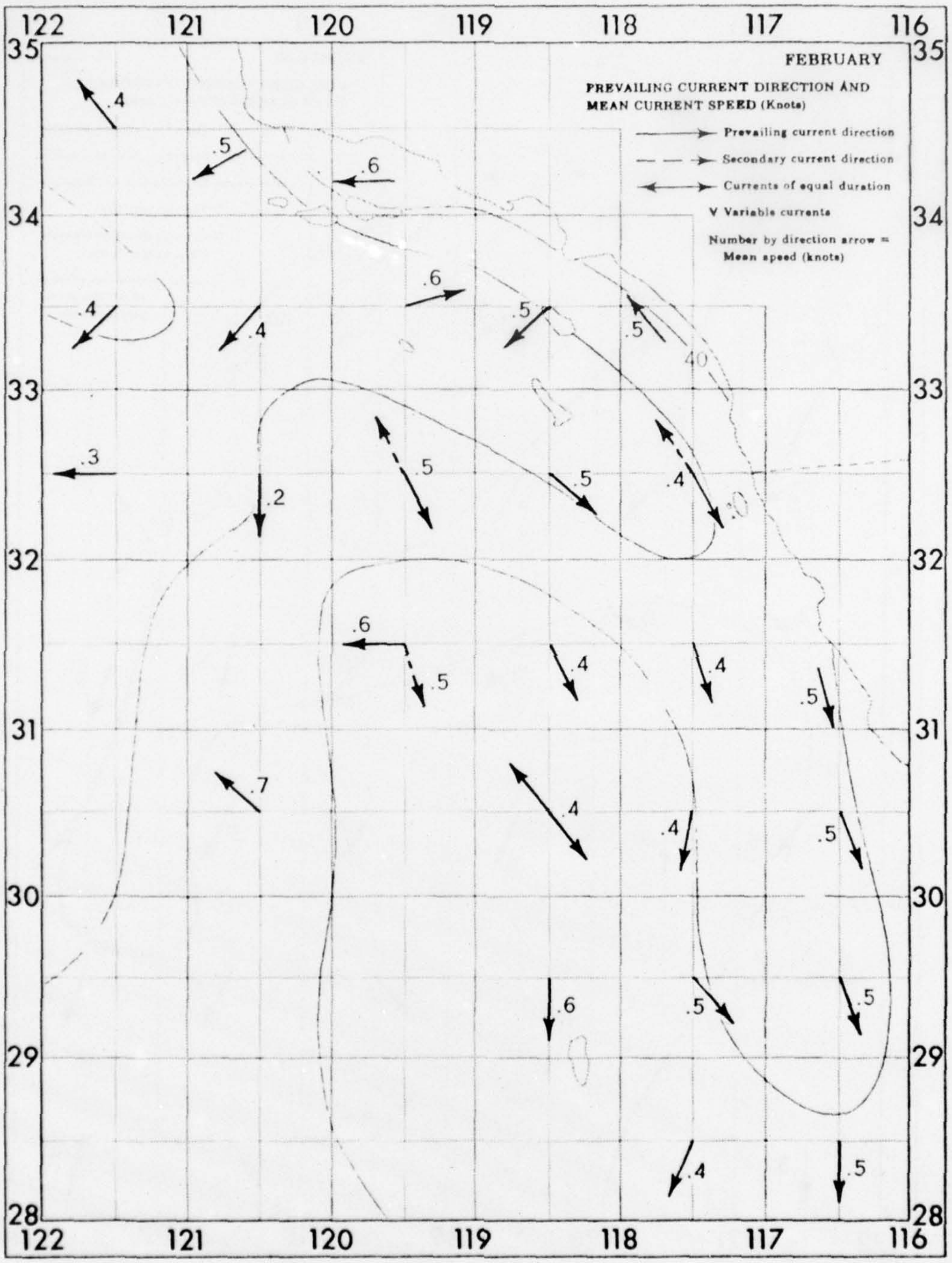


Figure 61. February

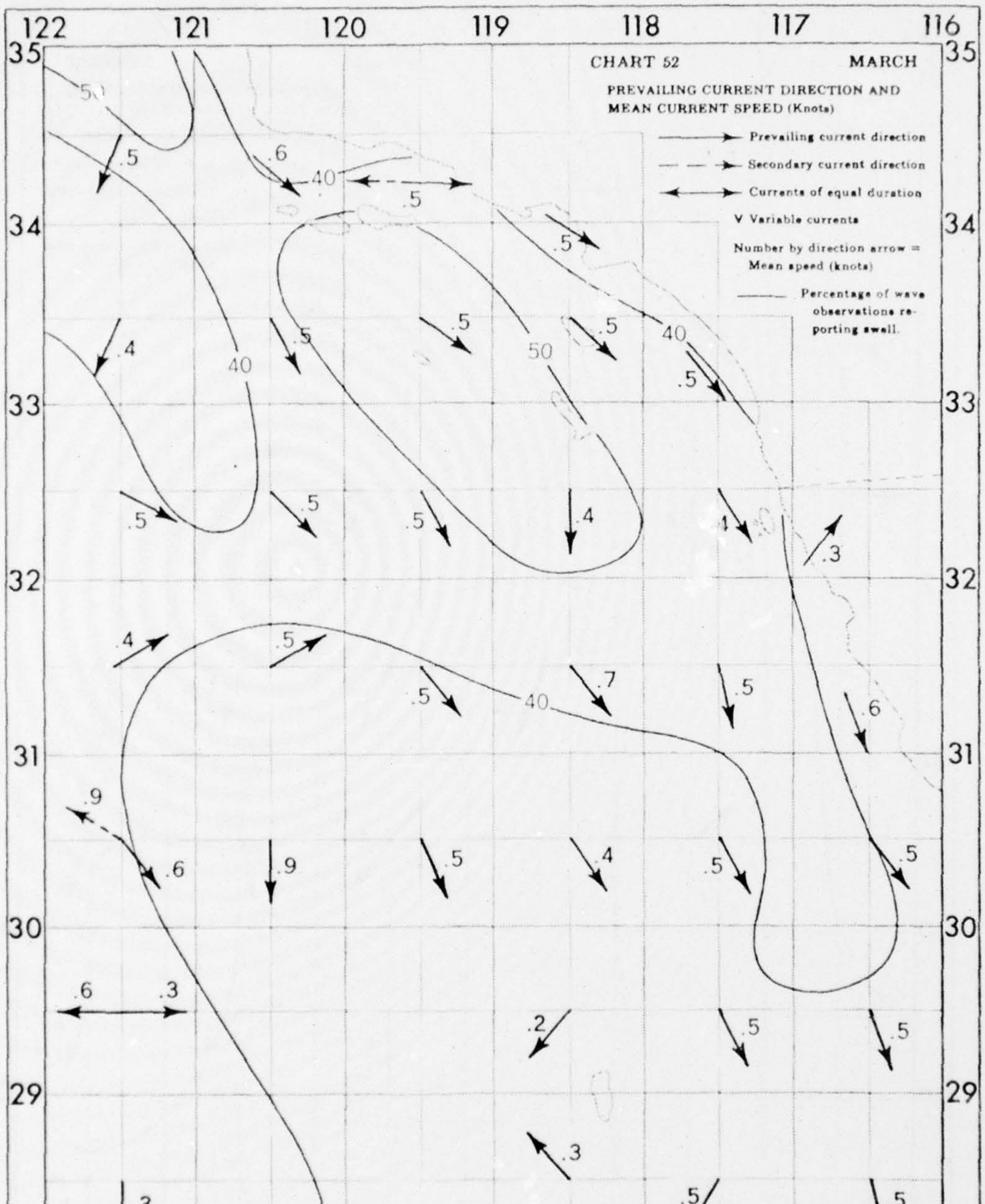


Figure 62. March

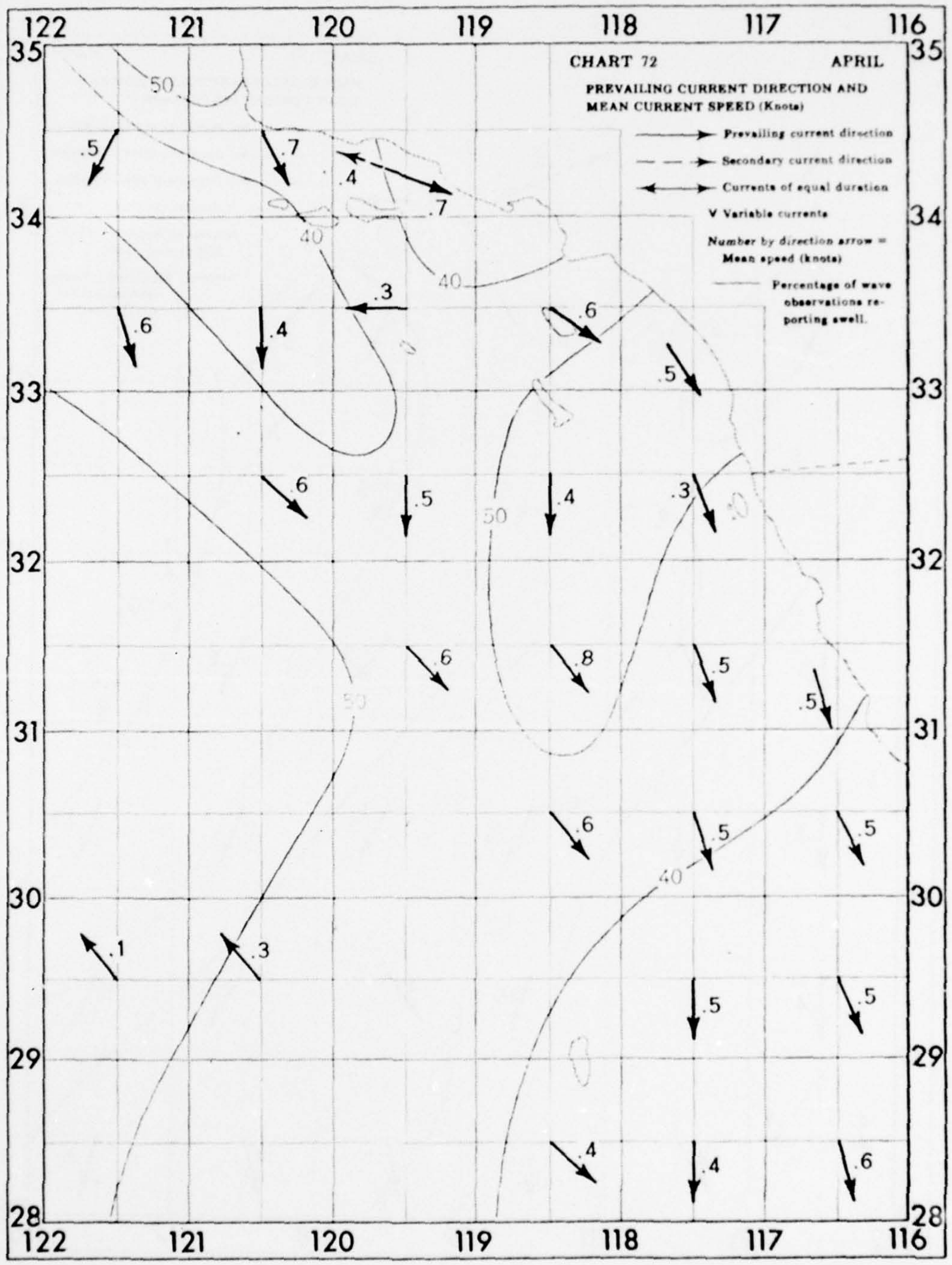


Figure 63. April

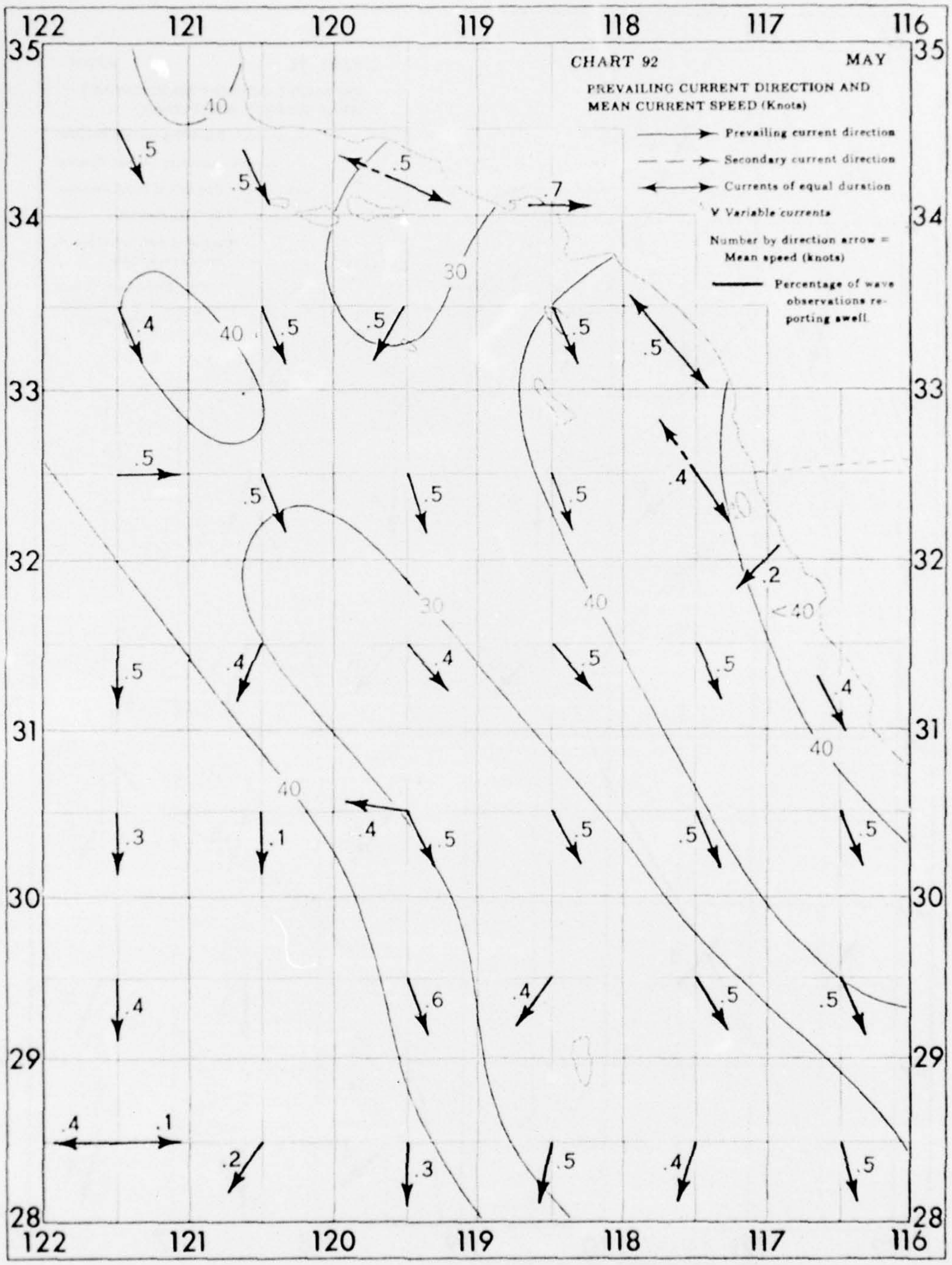


Figure 64. May

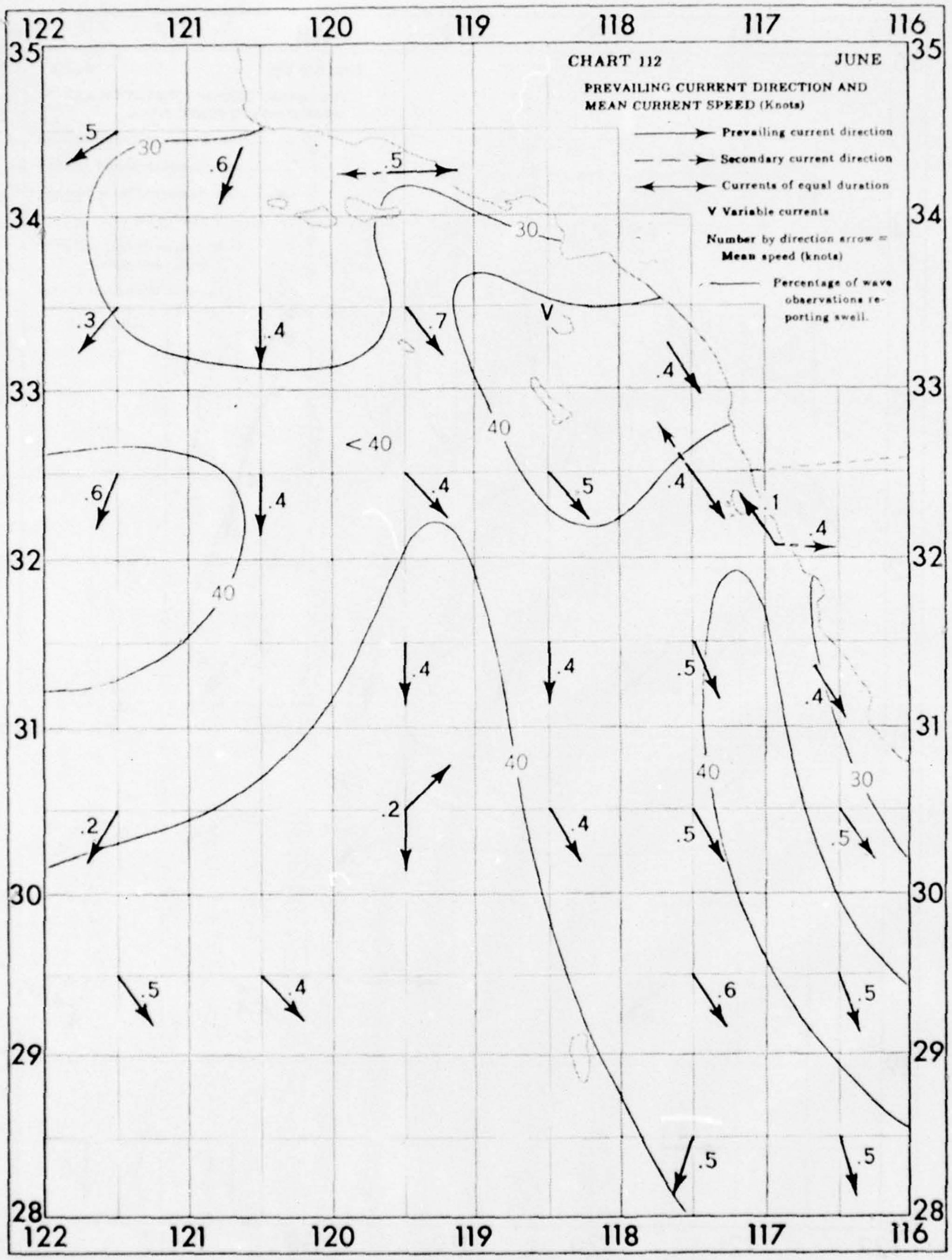


Figure 65, June

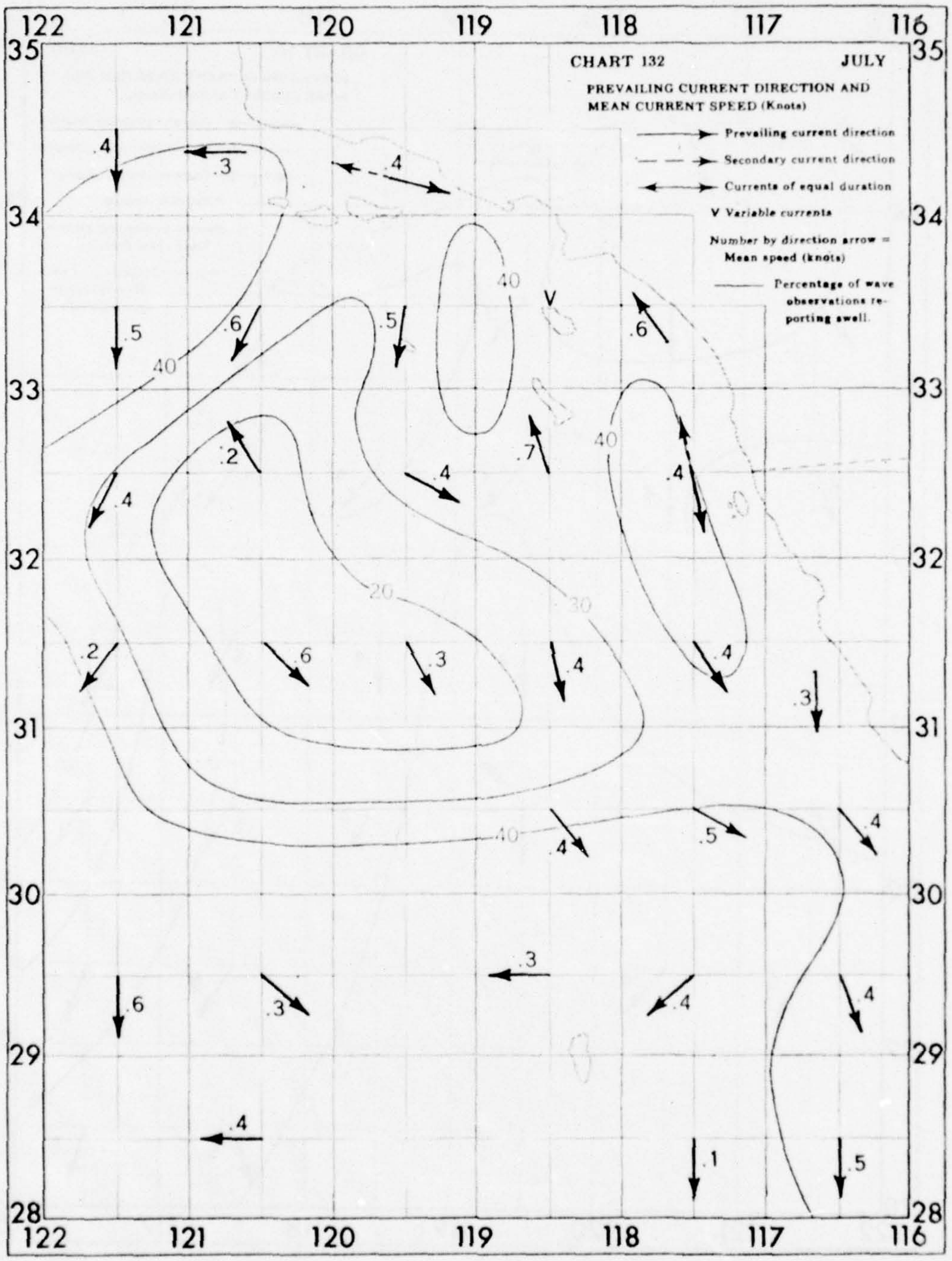


Figure 66. July

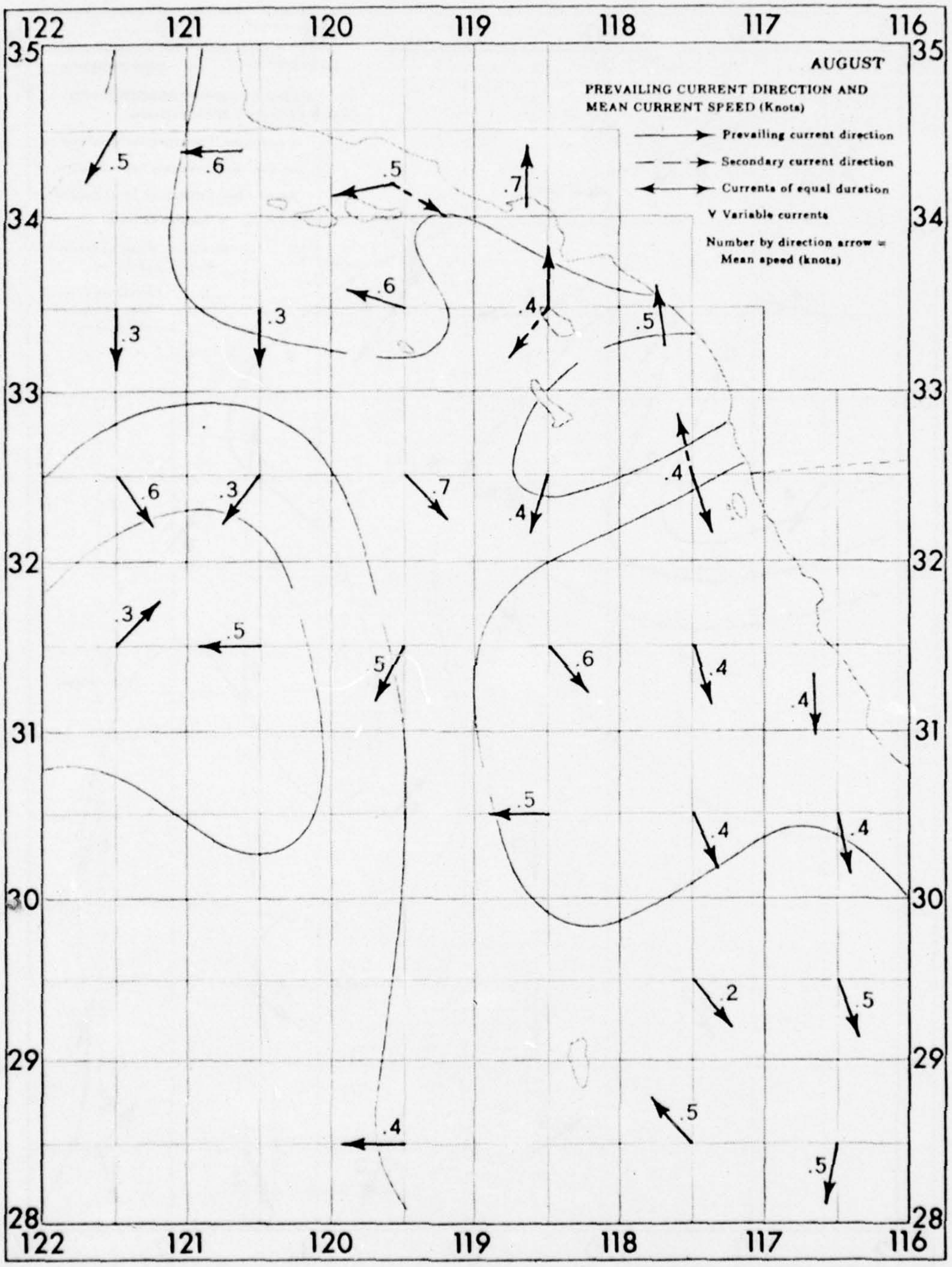


Figure 67. August

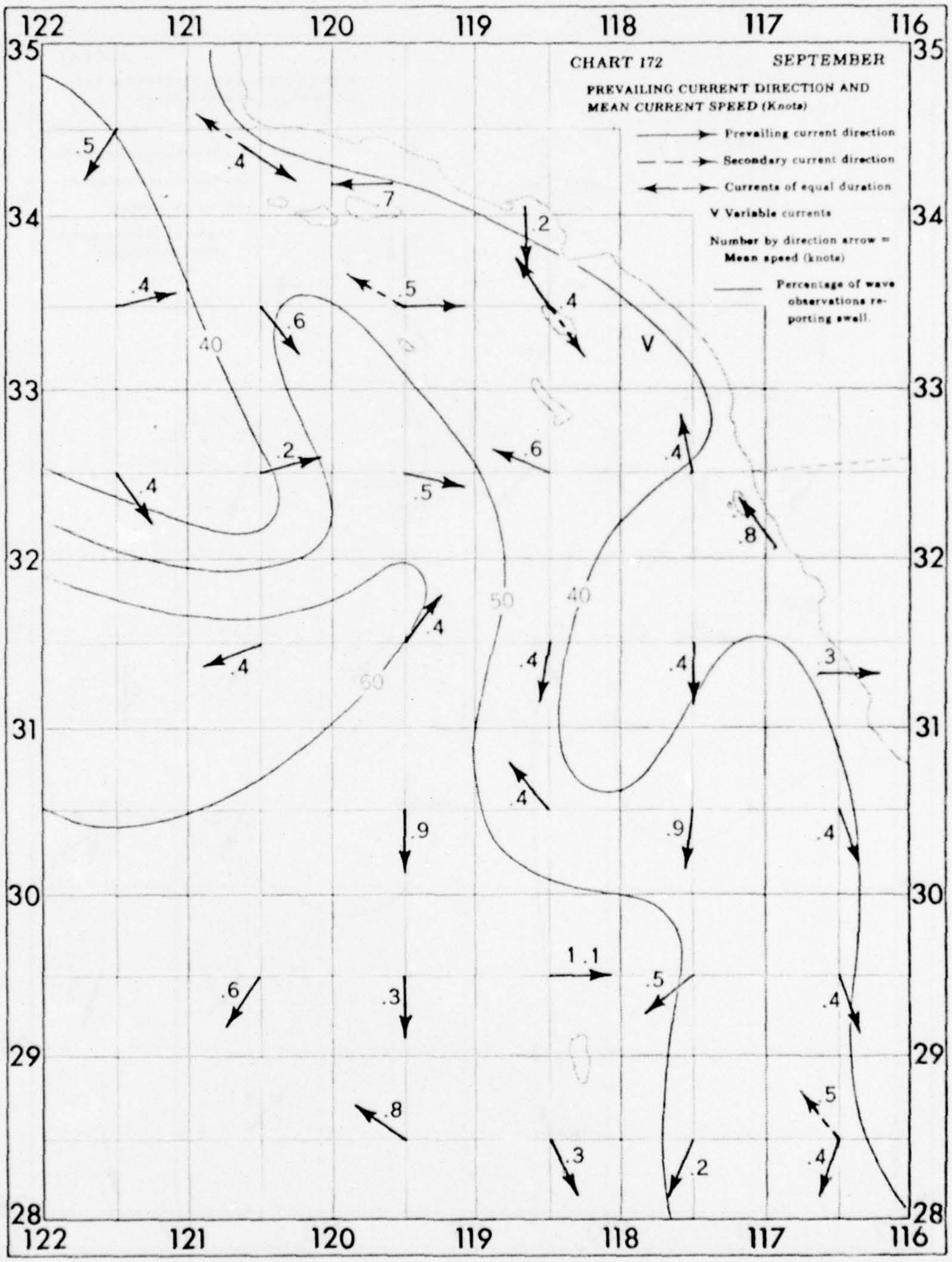


Figure 68. September

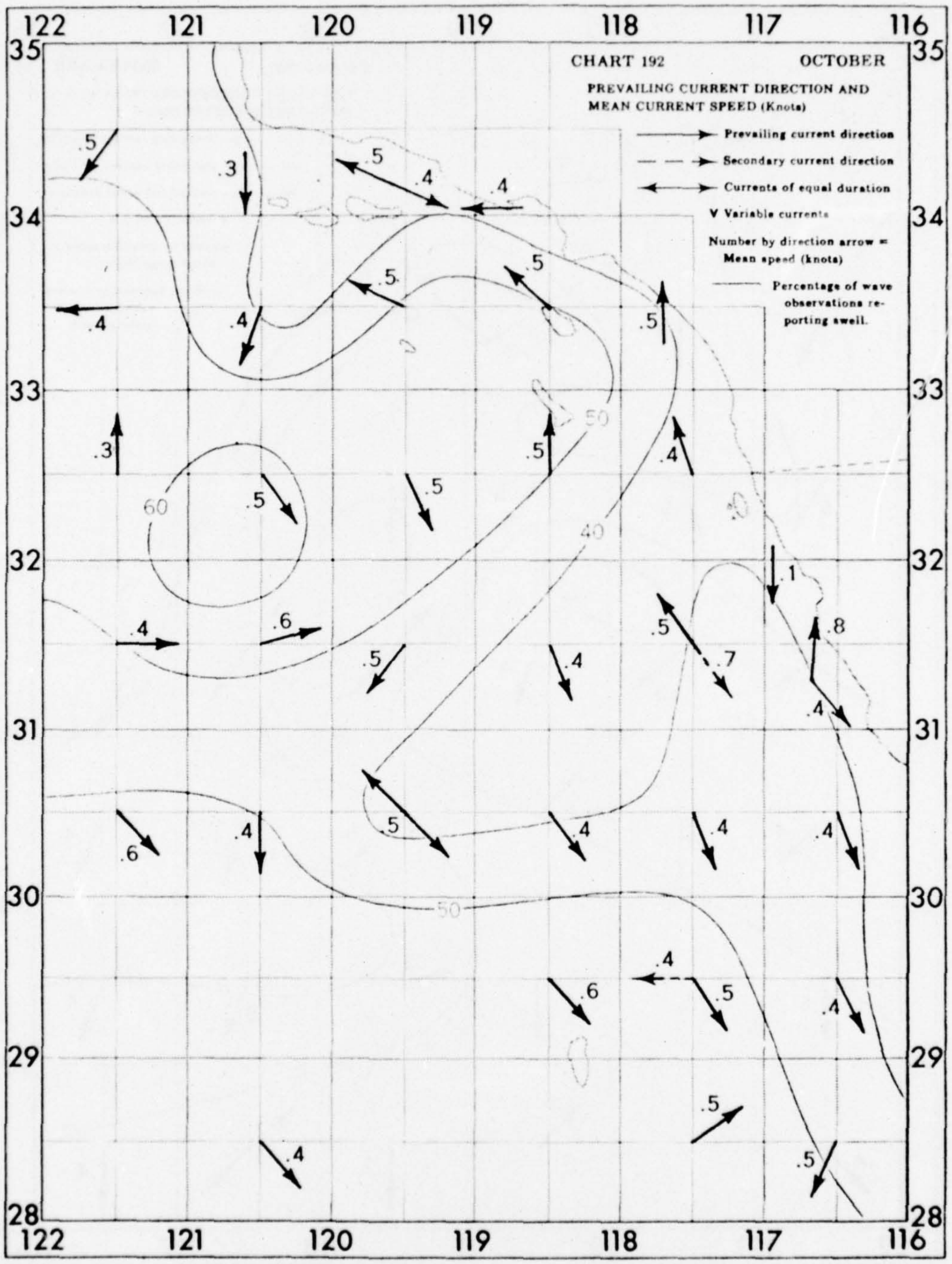


Figure 69. October

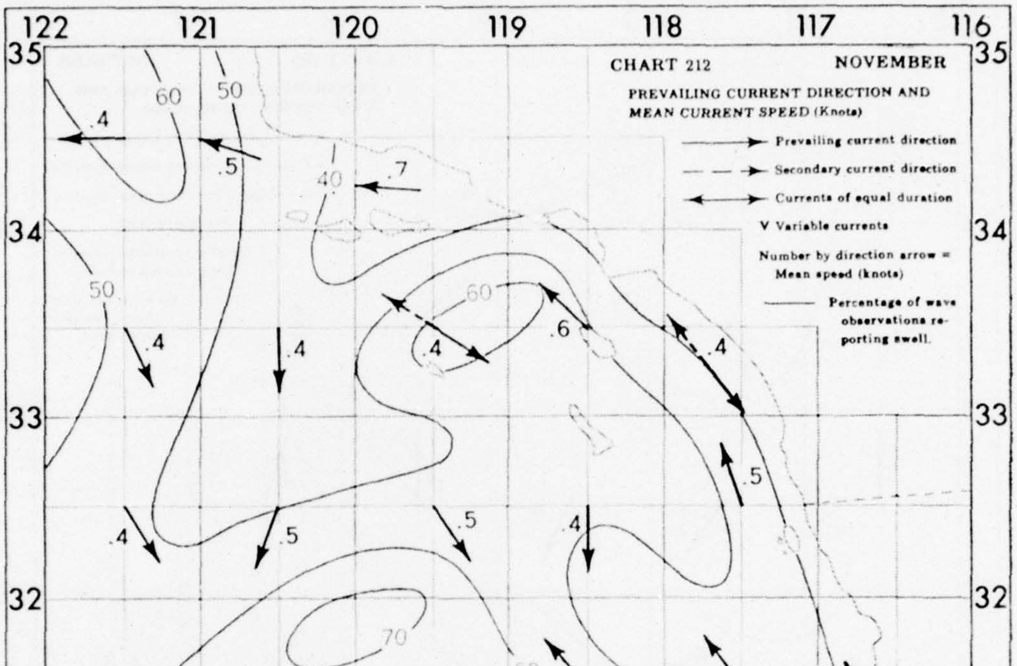


Figure 70. November

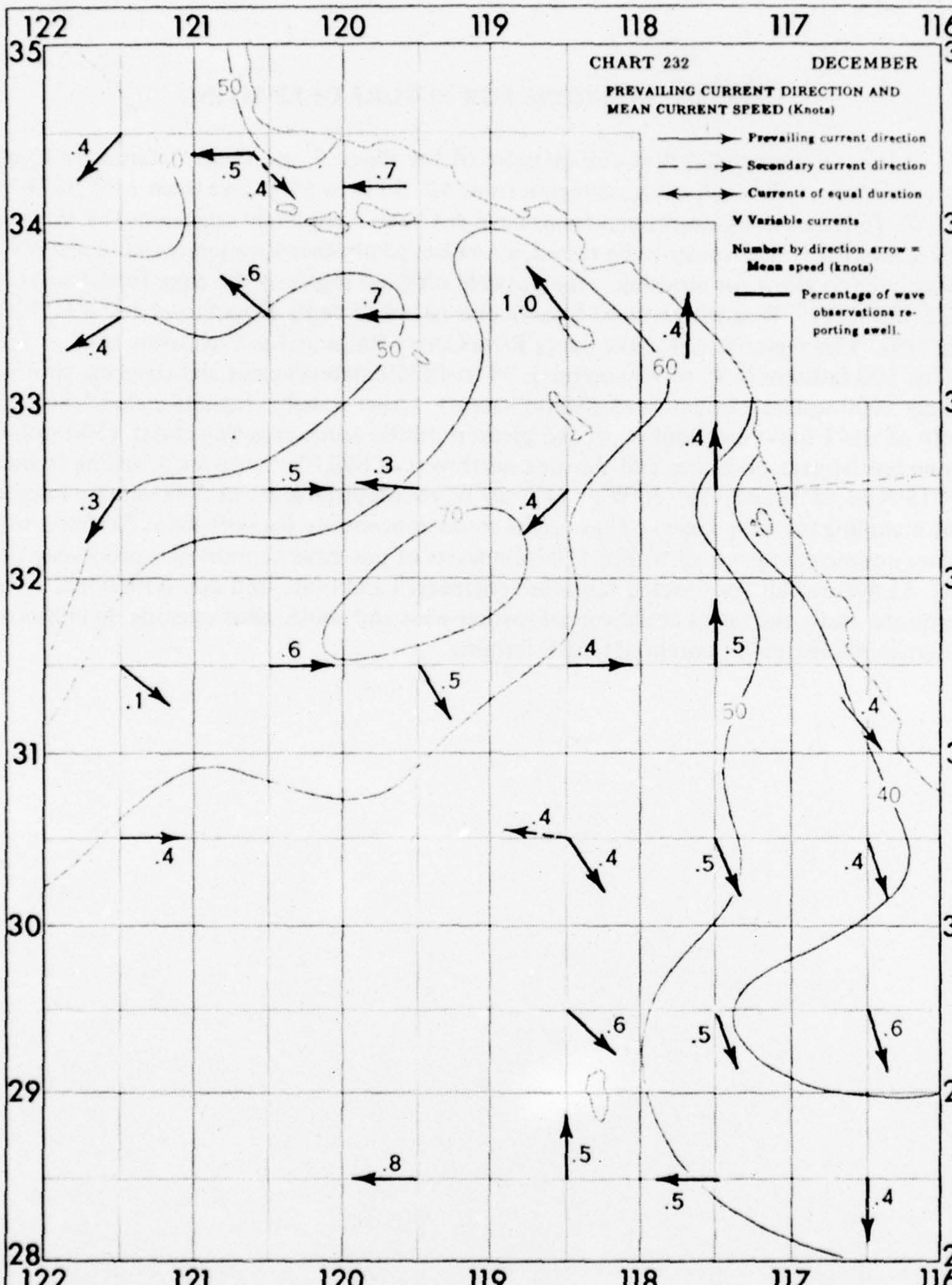


Figure 71. December

RECOMMENDATIONS FOR FUTURE OFEF SITING

It is recommended that one or more of the Phase 2 and Phase 3 farms be located in the southern California offshore region from 32° 30'N to 34°N and from 117° 30'W to 120°W. If dynamically-positioned farms have not been completely engineered by the time large-scale OFEF's are ready to be tested, a number of possible locations exist in water shallow enough to allow for mooring. One possible offshore region is the zone from Cortes Bank at 32° 30'N, 119°W northwest past San Nicolas Island to Santa Rosa Island at 34°N, 120°W (Fig. 49). This region is called the Santa Rosa-Cortes Ridge and is a relatively shallow region, 100 to 500 fathoms (180 to 900 meters), 24 to 40 kilometers across and covering approximately 5000 square kilometers (1,280,000 acres). Other possible regions include the area south of site 1 between commercial and pleasure traffic zones covering about 1300 square kilometers of nearshore sites and the area northwest of San Clemente and Catalina Islands, 33° 15'N to 34°N and 118° 20'W to 119° 20'W, encompassing about 2600 square kilometers (not including shipping lanes). These areas could conceivably support some 22 Phase-1 (405 square kilometer) farms, all within 120 kilometers of potential support and processing centers. As dynamically-positioned farms are engineered and built, and as international agreements are made, the farms could spread further west and south, thus opening up millions of square kilometers to potential OFEF farming.

SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORTANCE TO THE SITE SELECTION OF AN OCEAN FOOD AND ENERGY FARM (OFEF) IN THE EASTERN PACIFIC.

APPENDICES A-E

APPENDIX A
SEASONAL NITRATE PROFILES FOR THE EASTERN PACIFIC OCEAN AREAS AS DEFINED IN FIGURE 1

Data for nitrate profiles were obtained from the National Oceanographic Data Center and summarized using the Naval Undersea Center UNIVAC 1110 computer and developed software.

Nitrate is given in micrograms-atoms/liter on a log scale and are shown to a maximum depth of 500 meters.

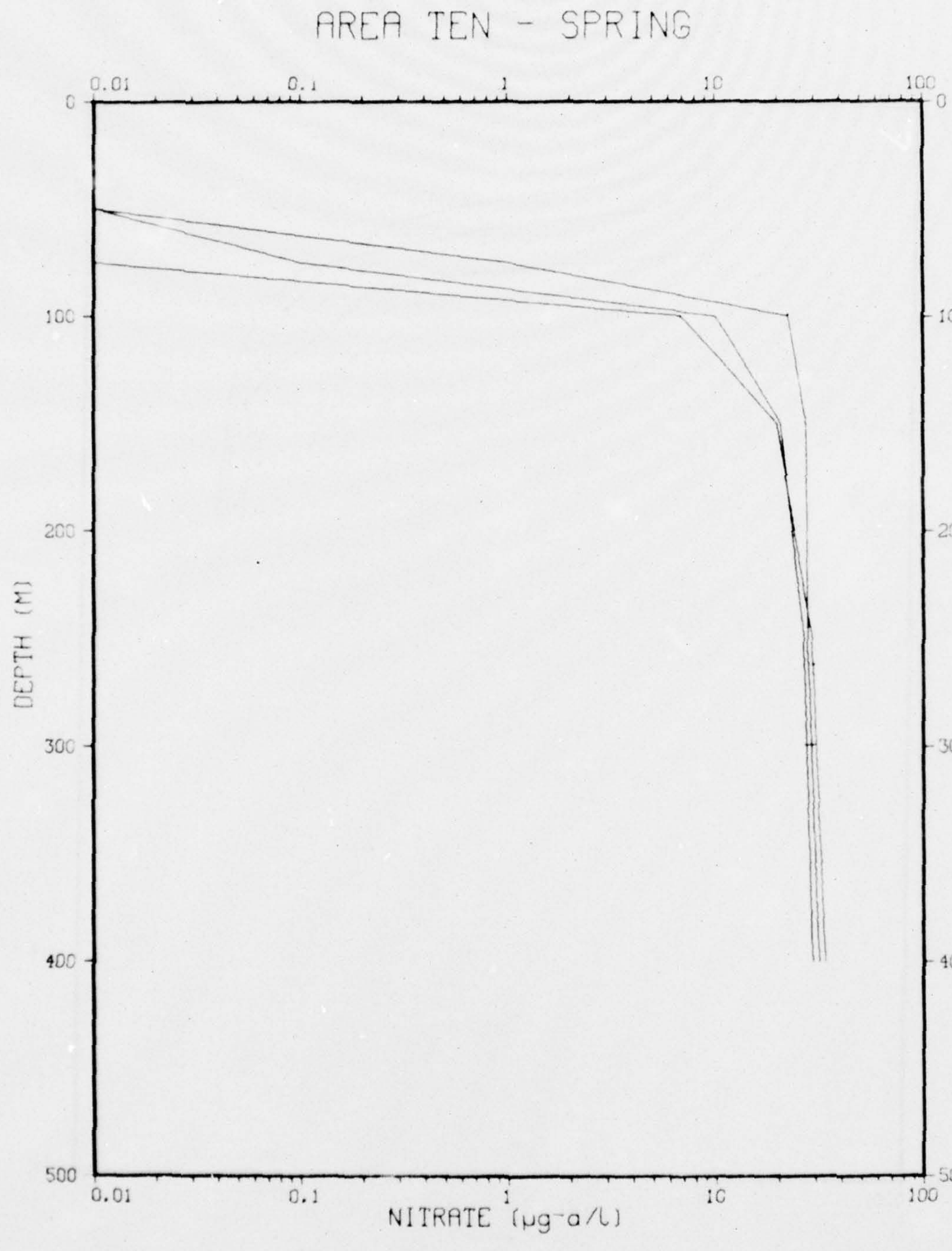

AREA TEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/L)

Figure A.1.

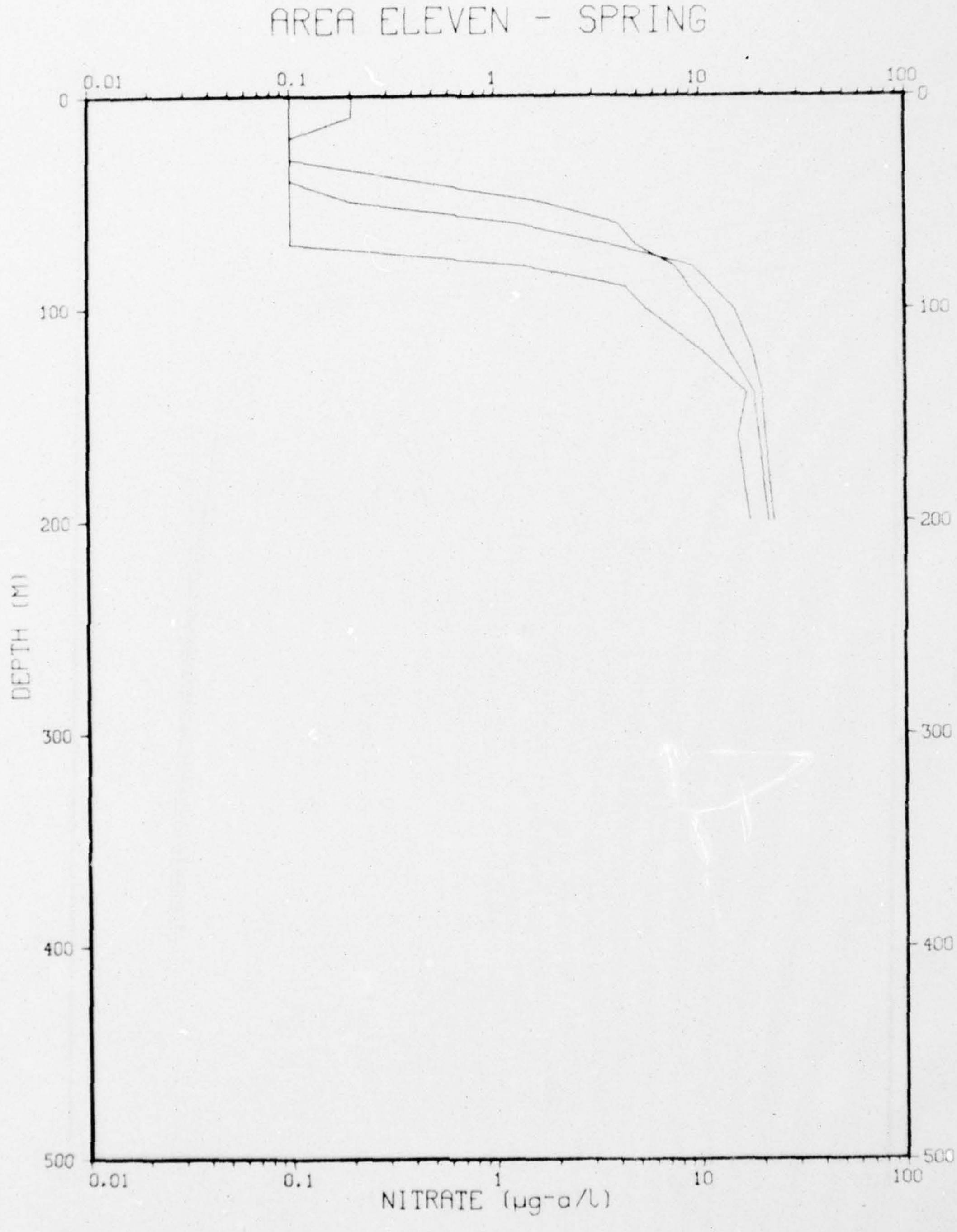

AREA ELEVEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.2.

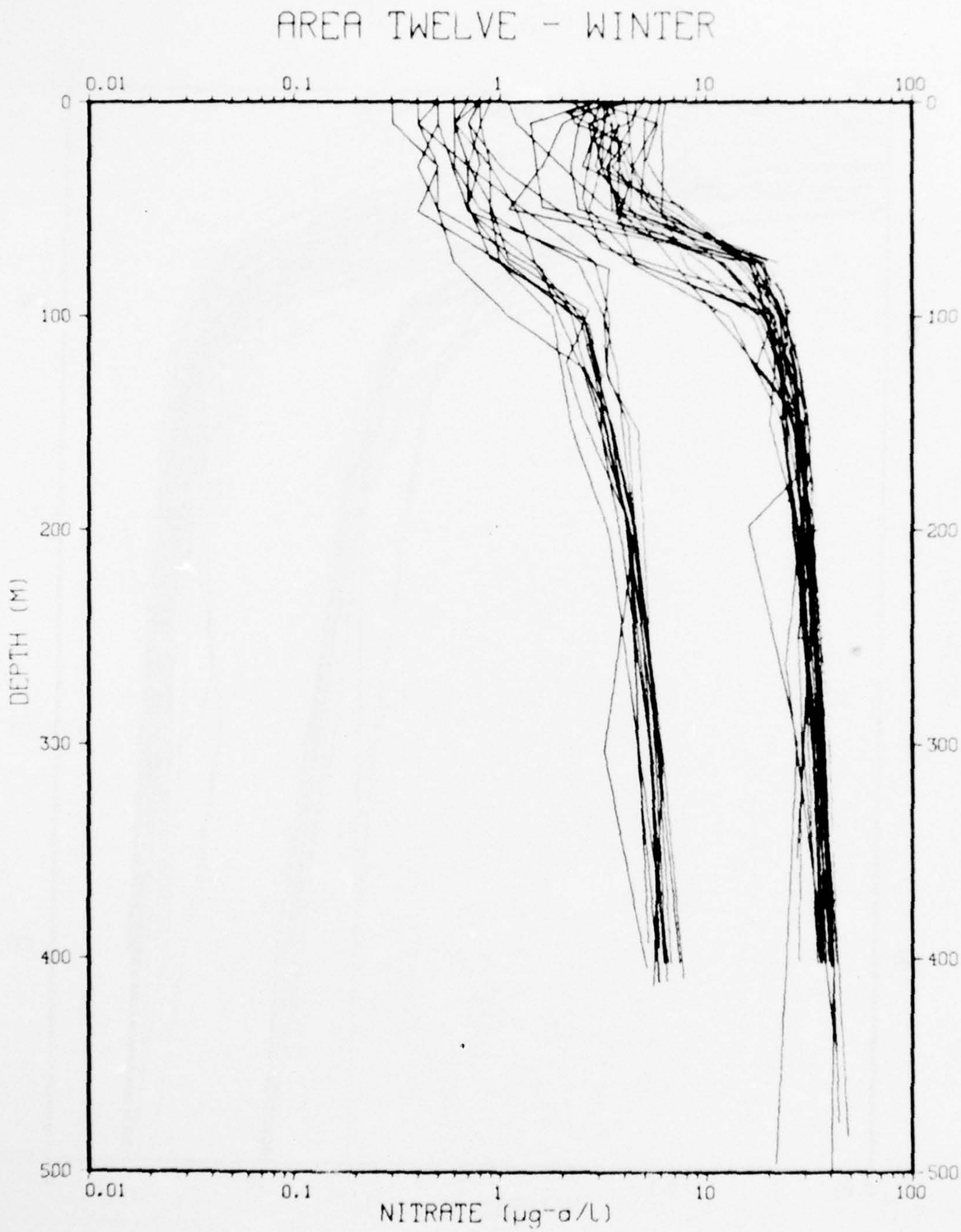

AREA TWELVE - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.3.

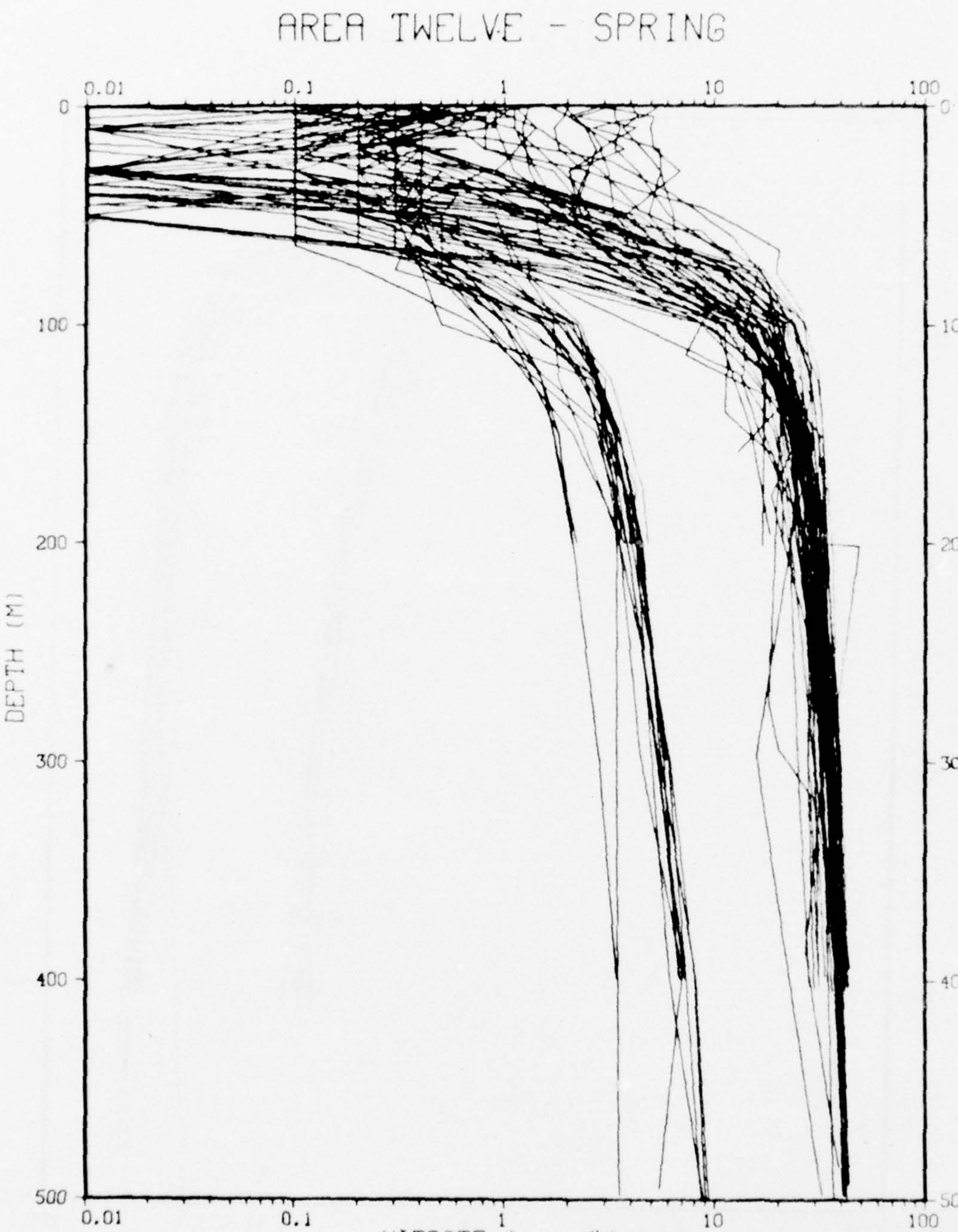

AREA TWELVE - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.4.

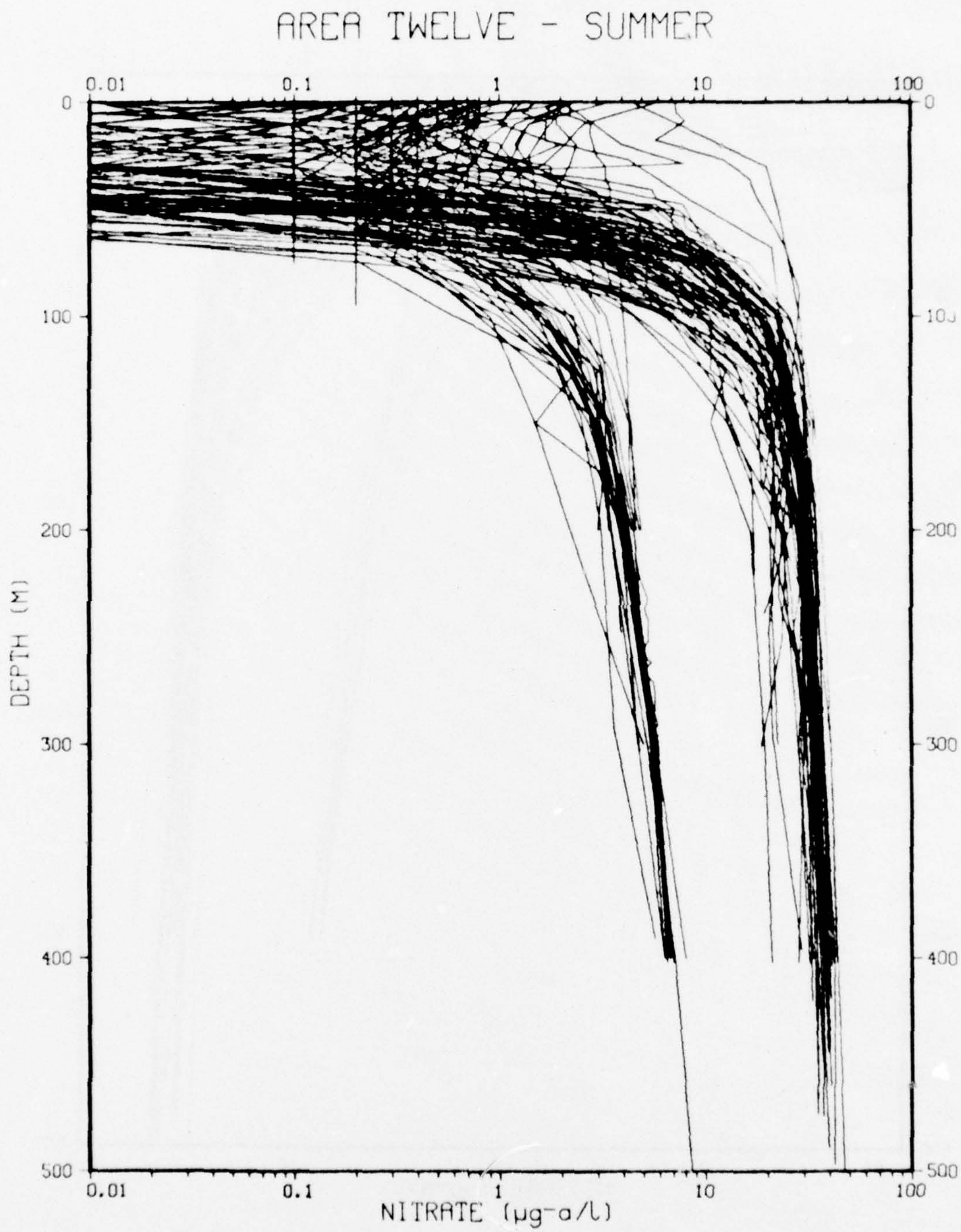
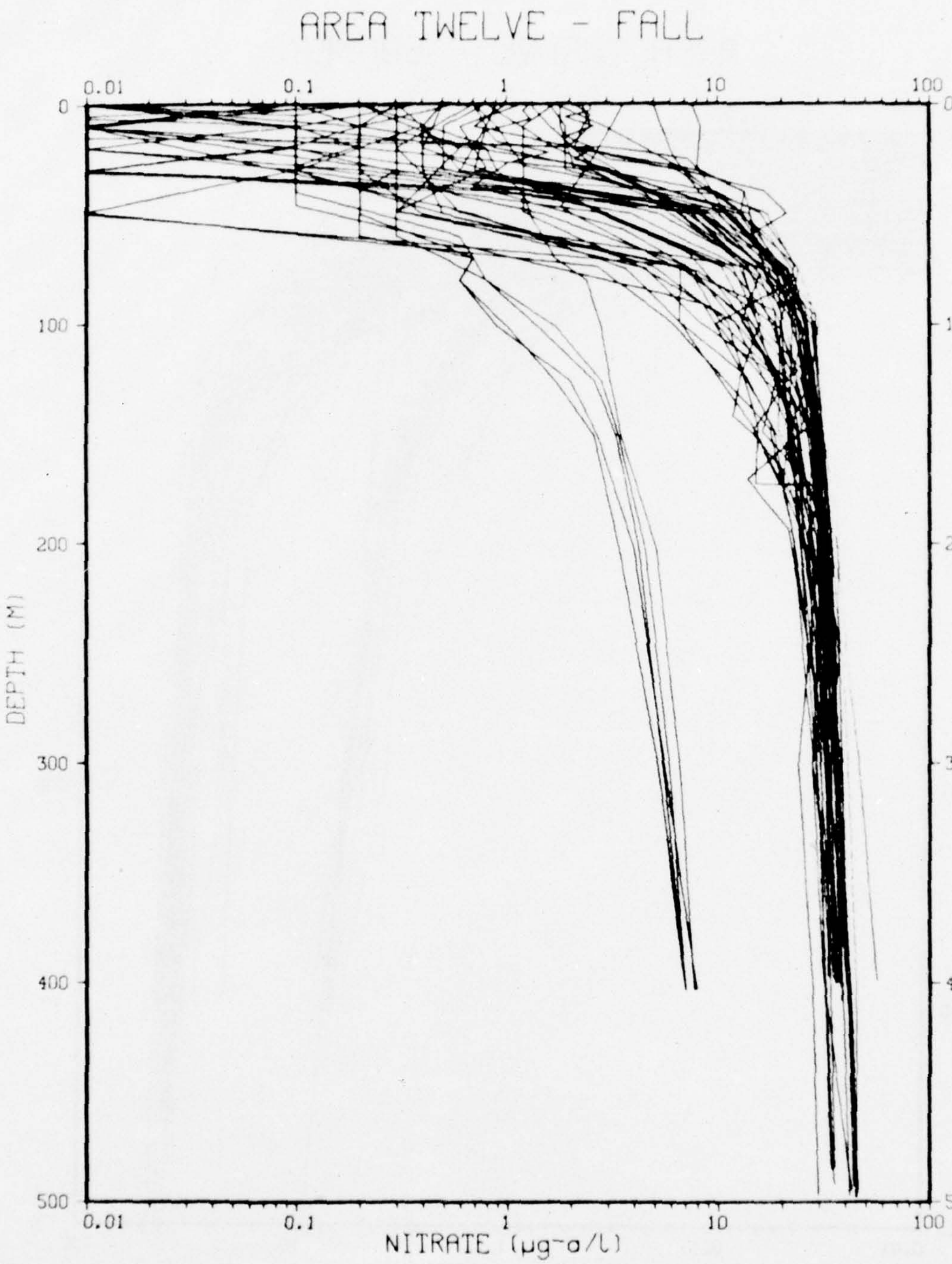

AREA TWELVE - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.5.



AREA TWELVE - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.6.

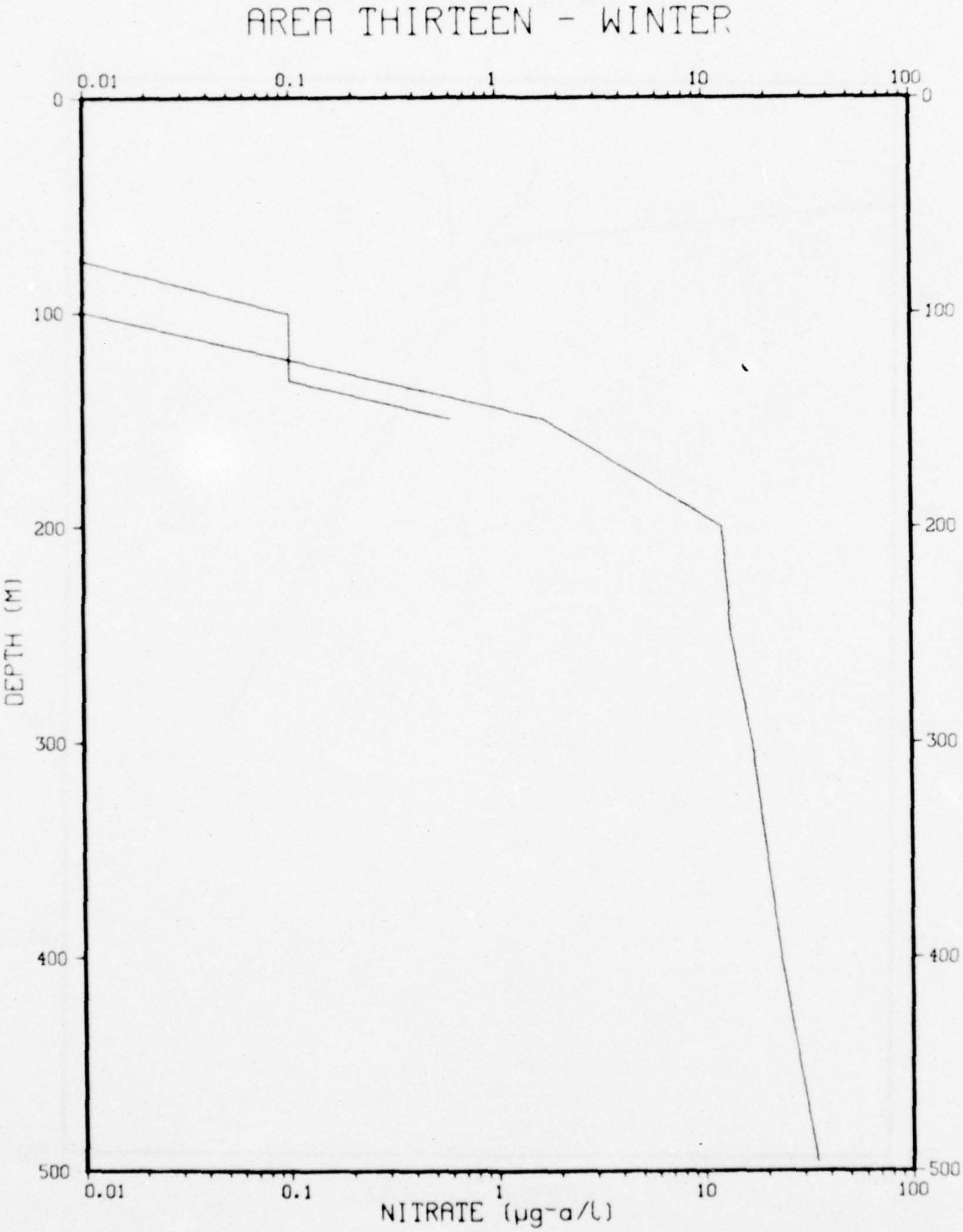
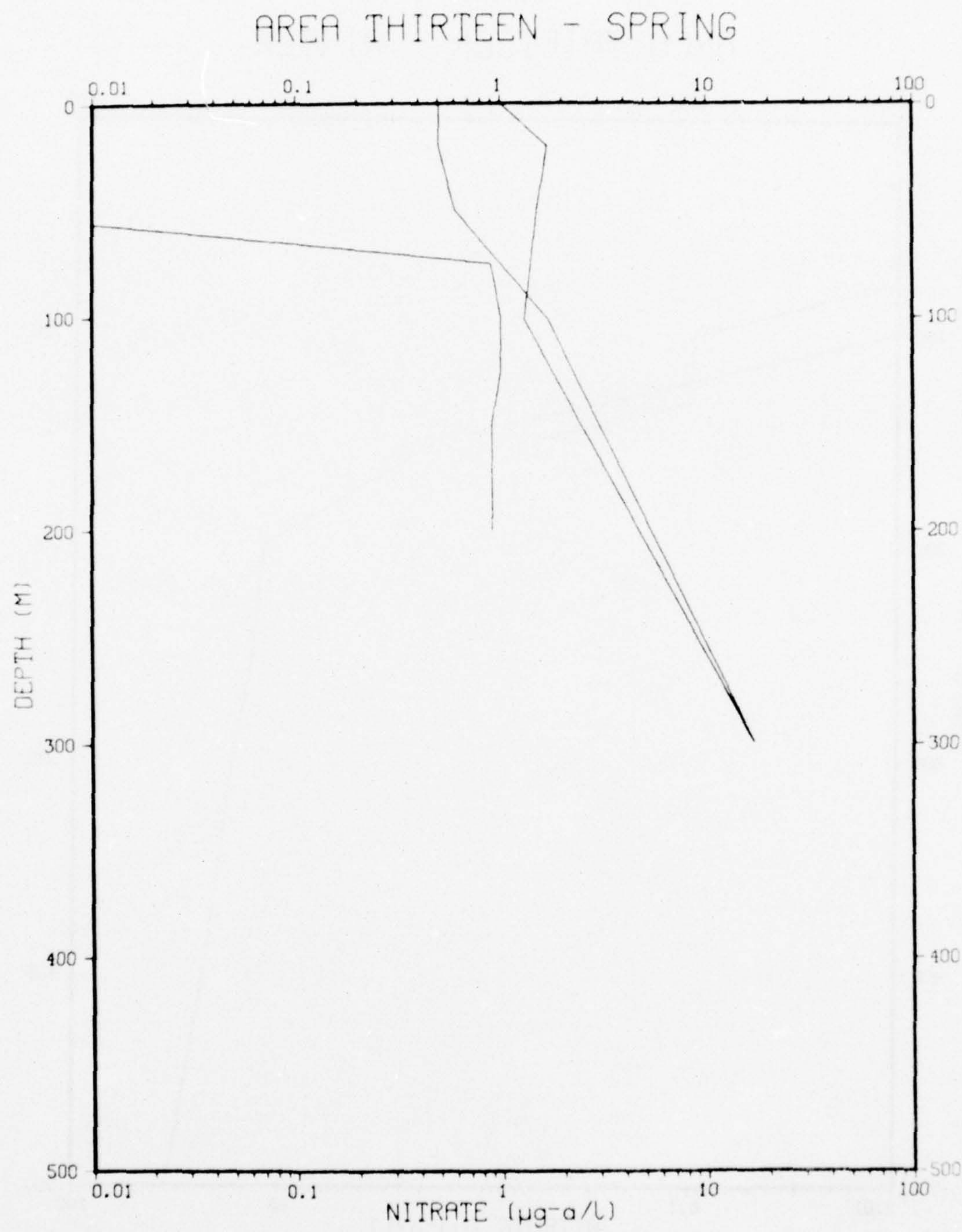

AREA THIRTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.7.



AREA THIRTEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.8.

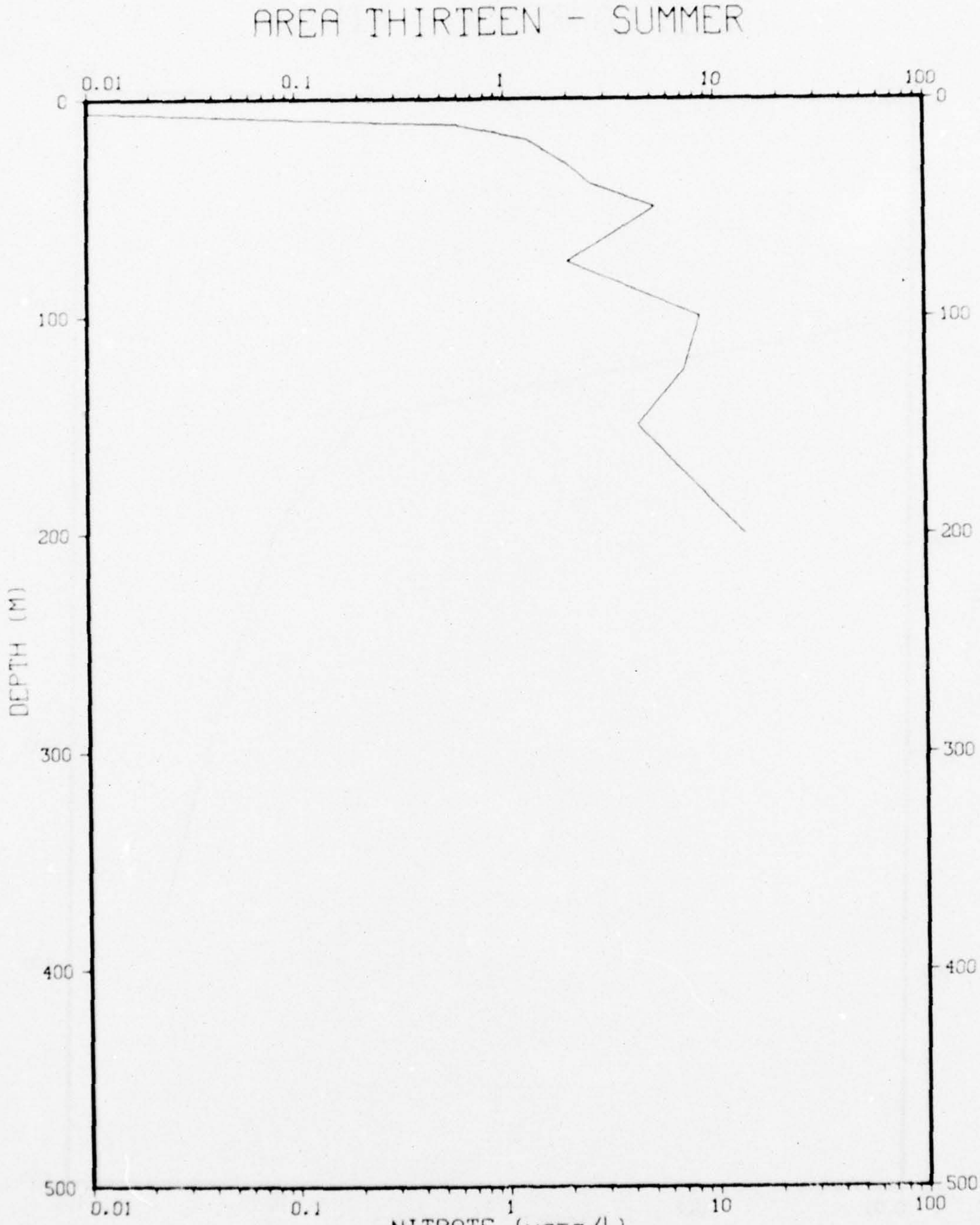
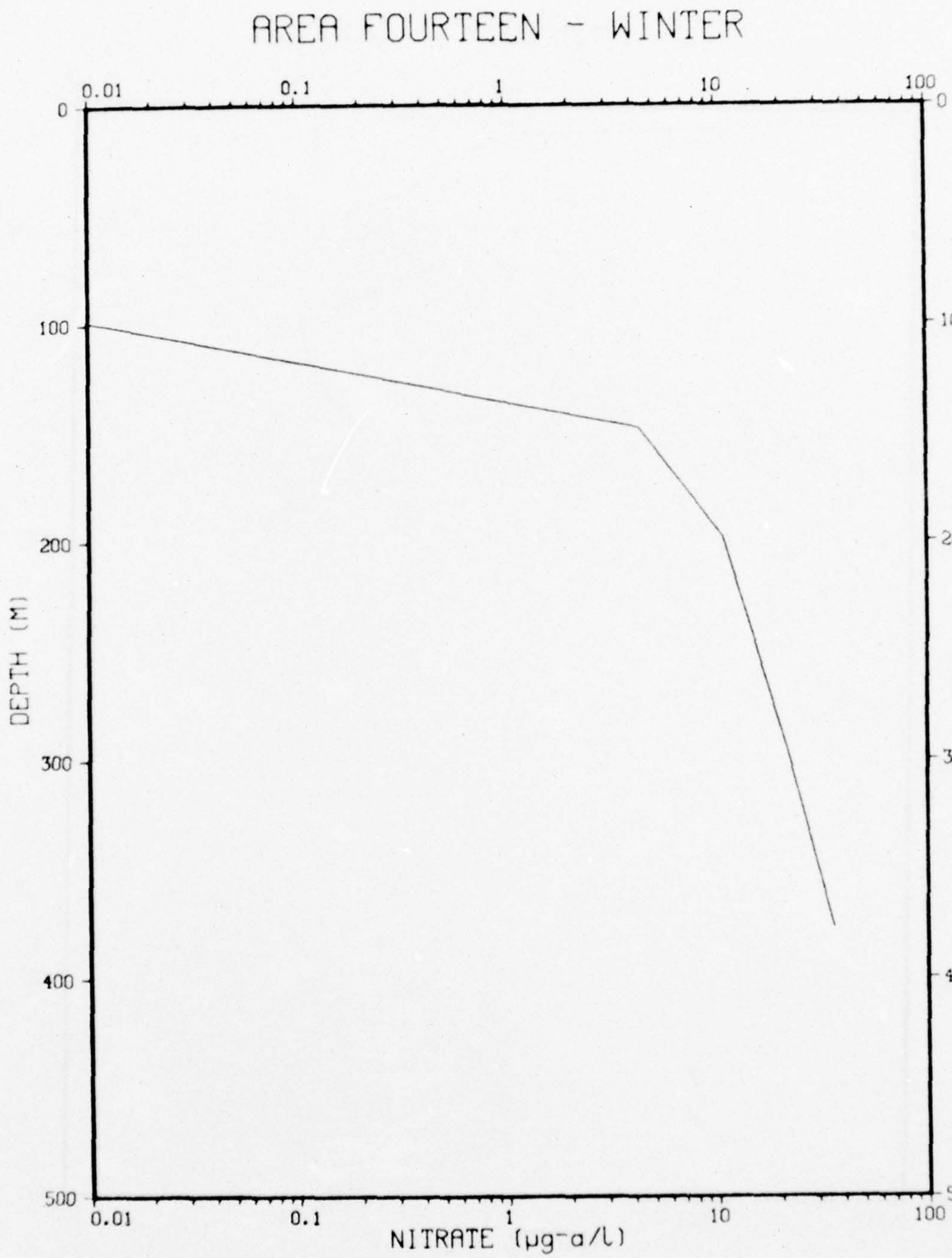

AREA THIRTEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.9.



AREA FOURTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.10.

AREA FOURTEEN - SPRING

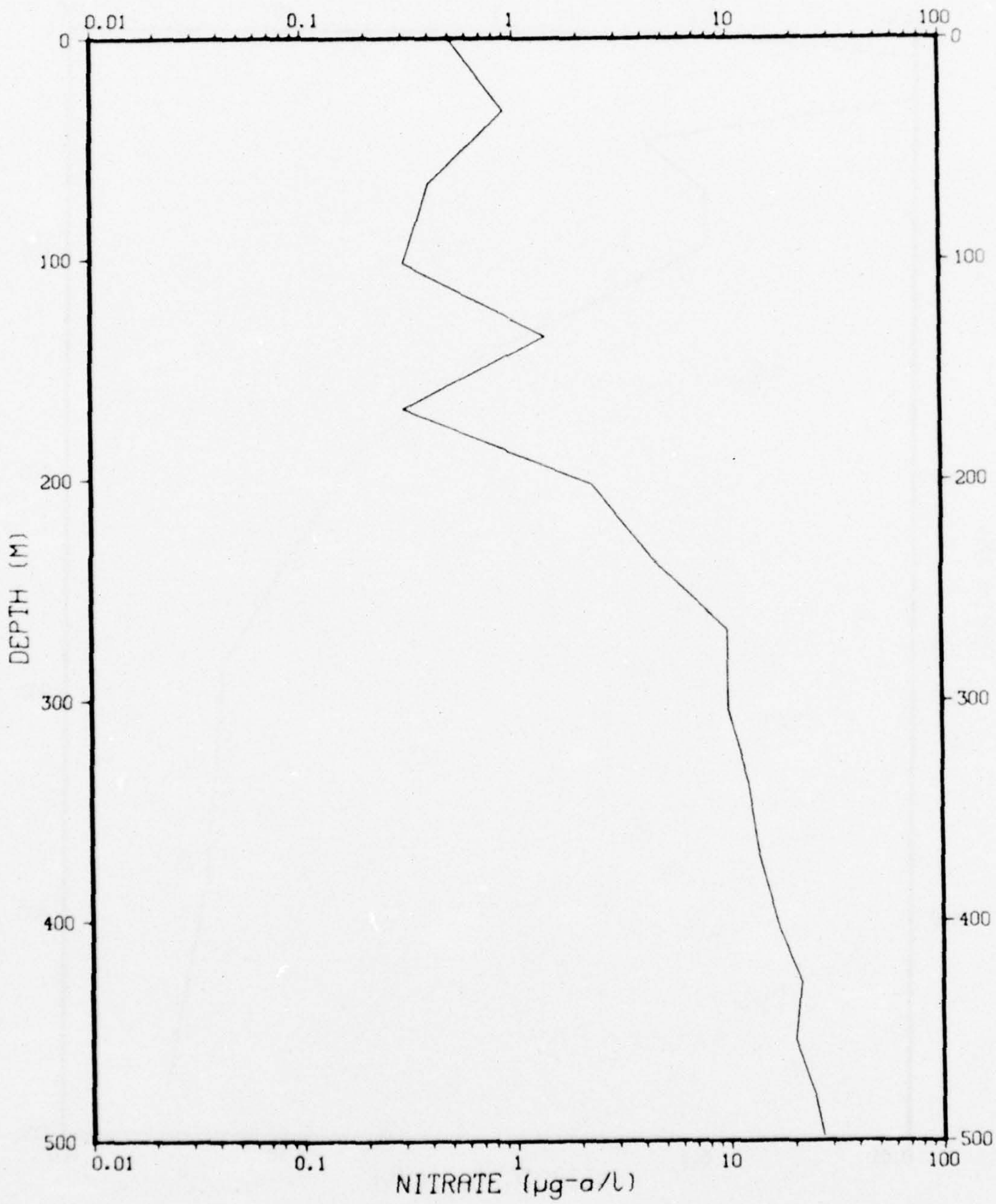


Figure A.11.

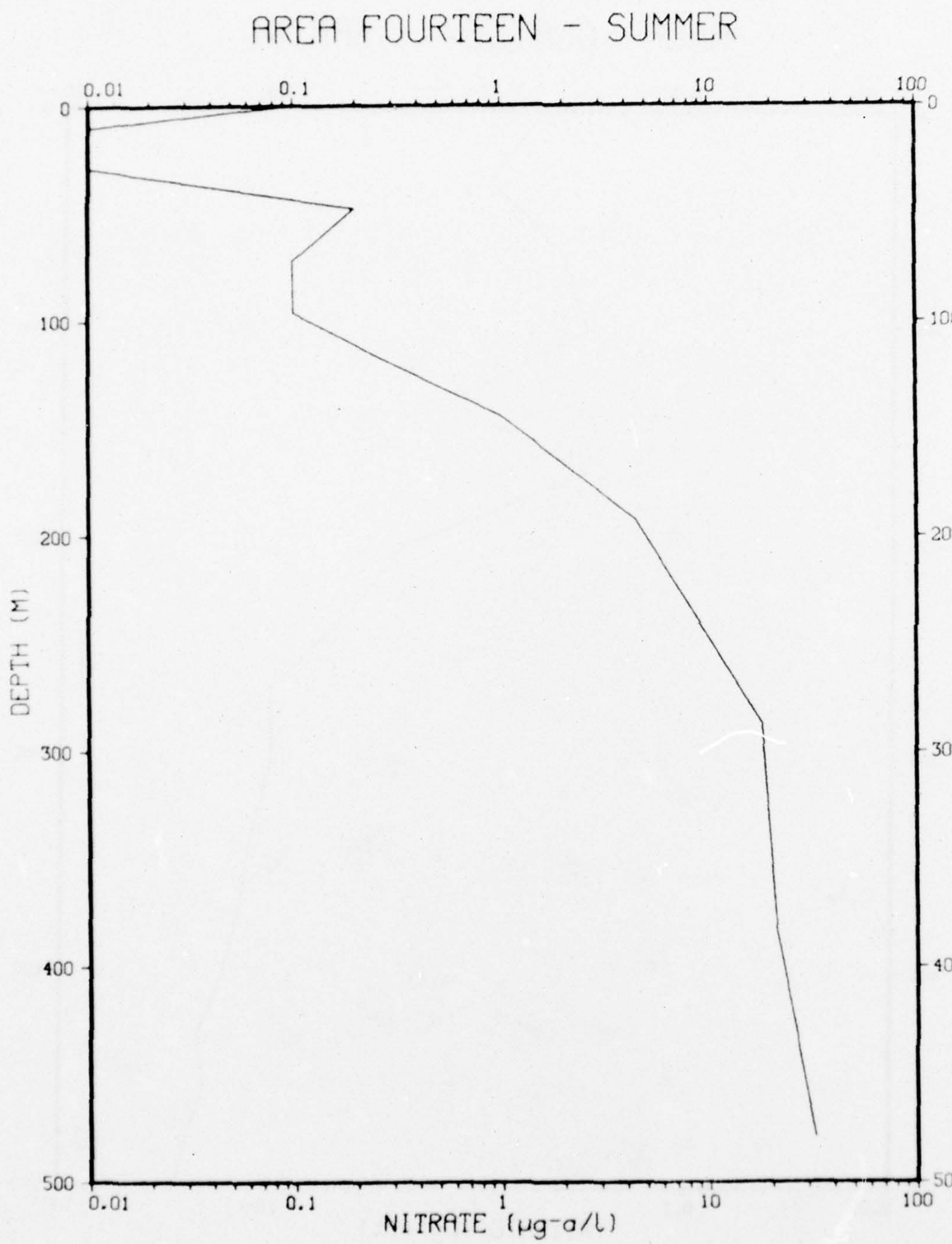

AREA FOURTEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.12.

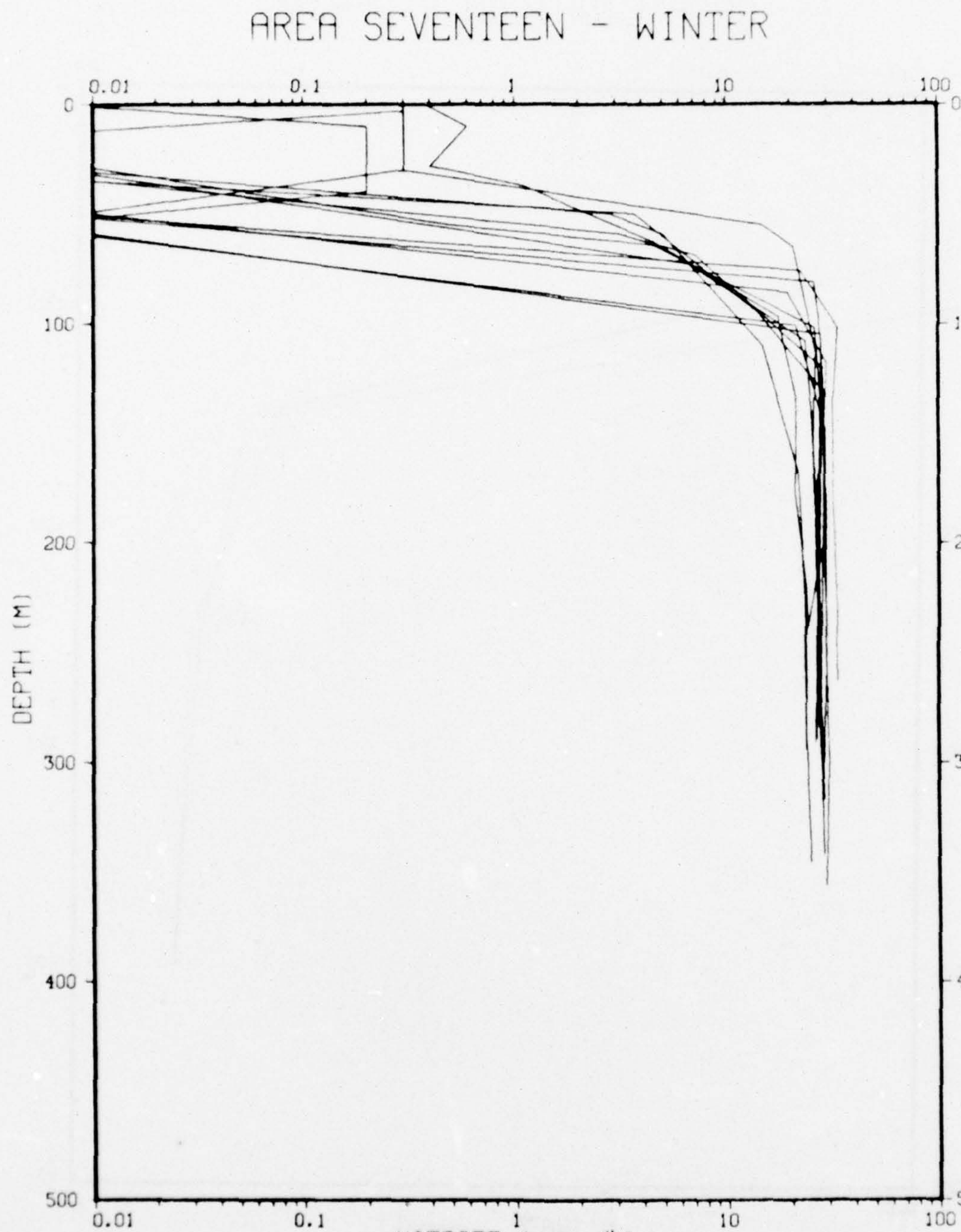

AREA SEVENTEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.13.

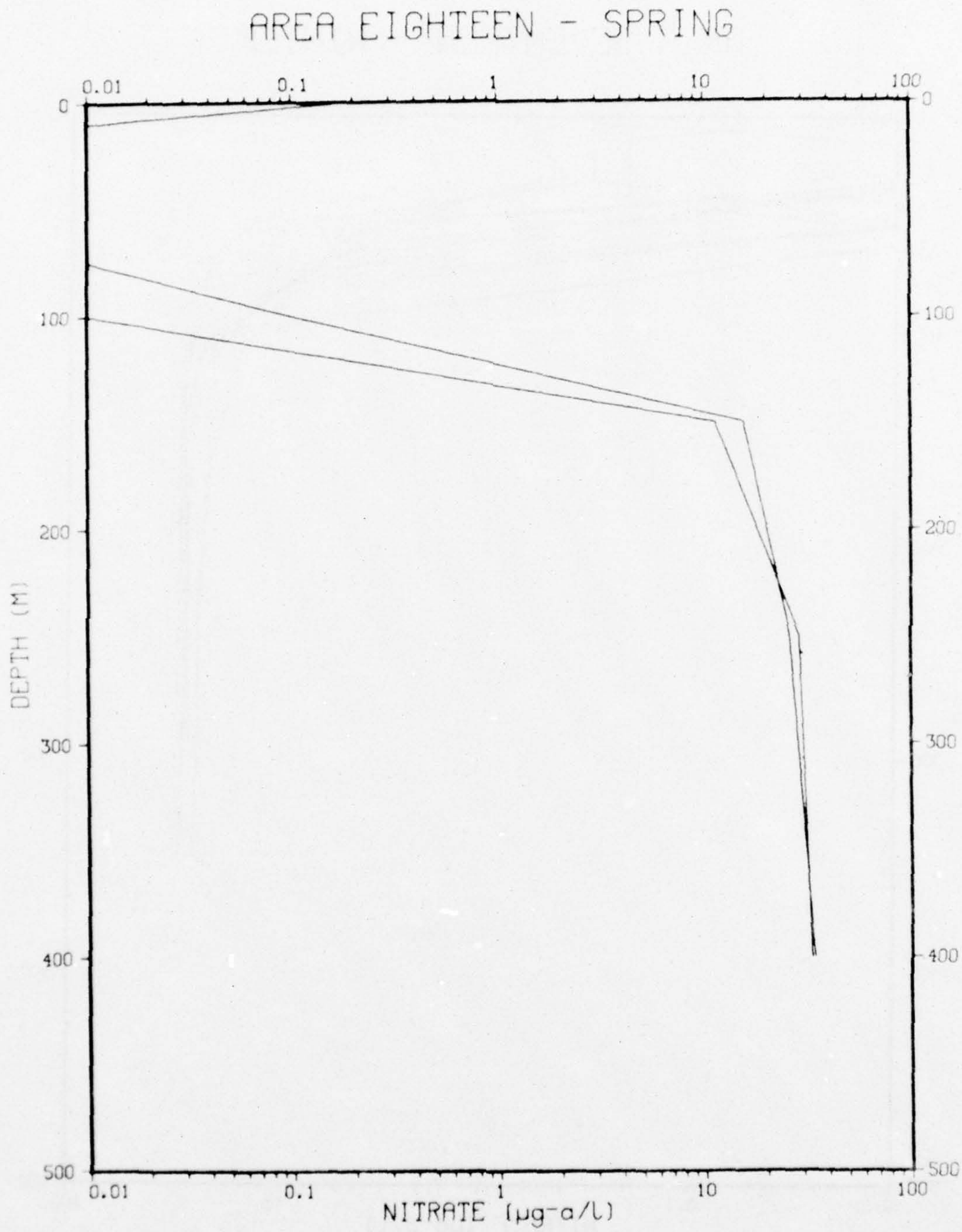

AREA EIGHTEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.14.

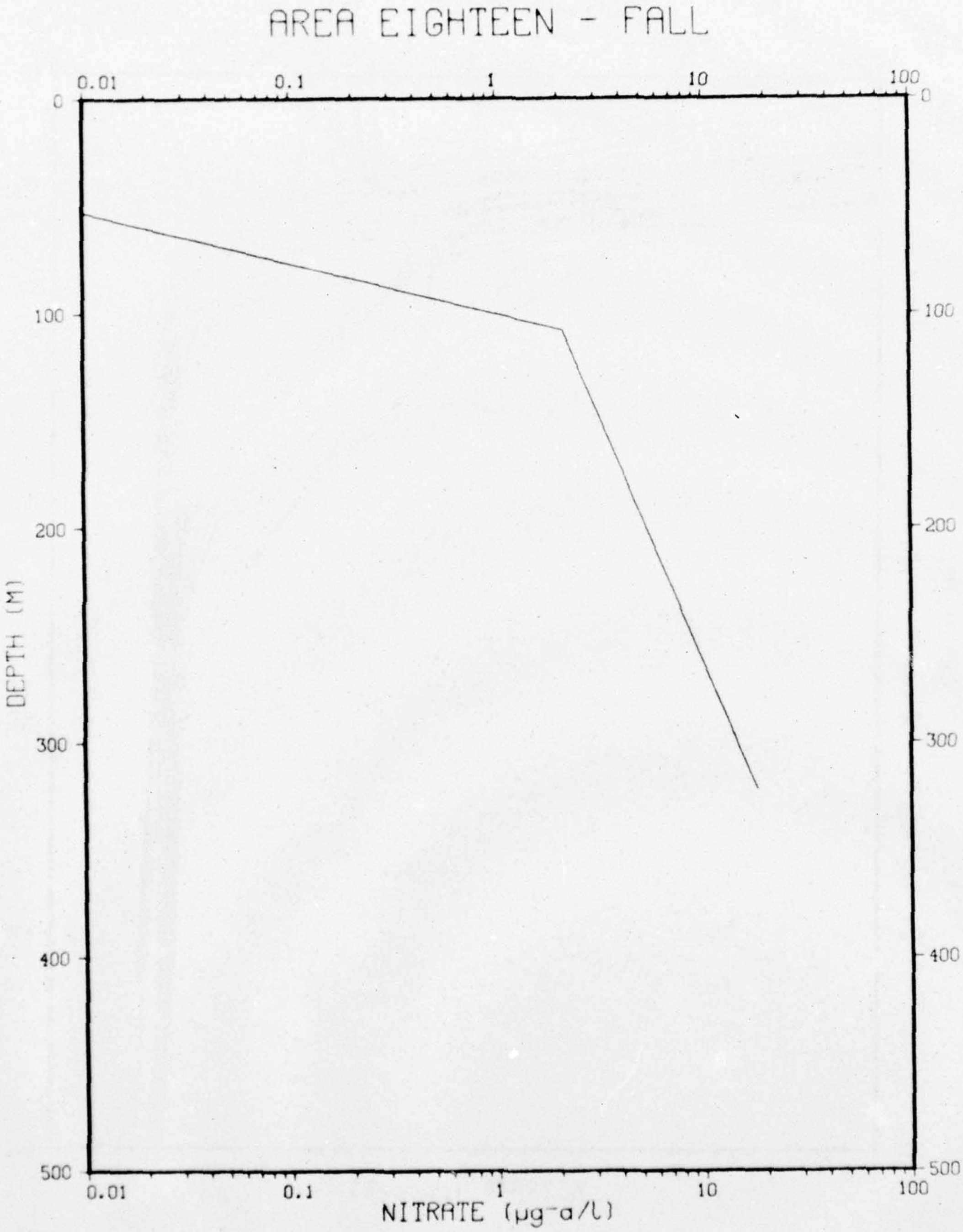

AREA EIGHTEEN - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.15.

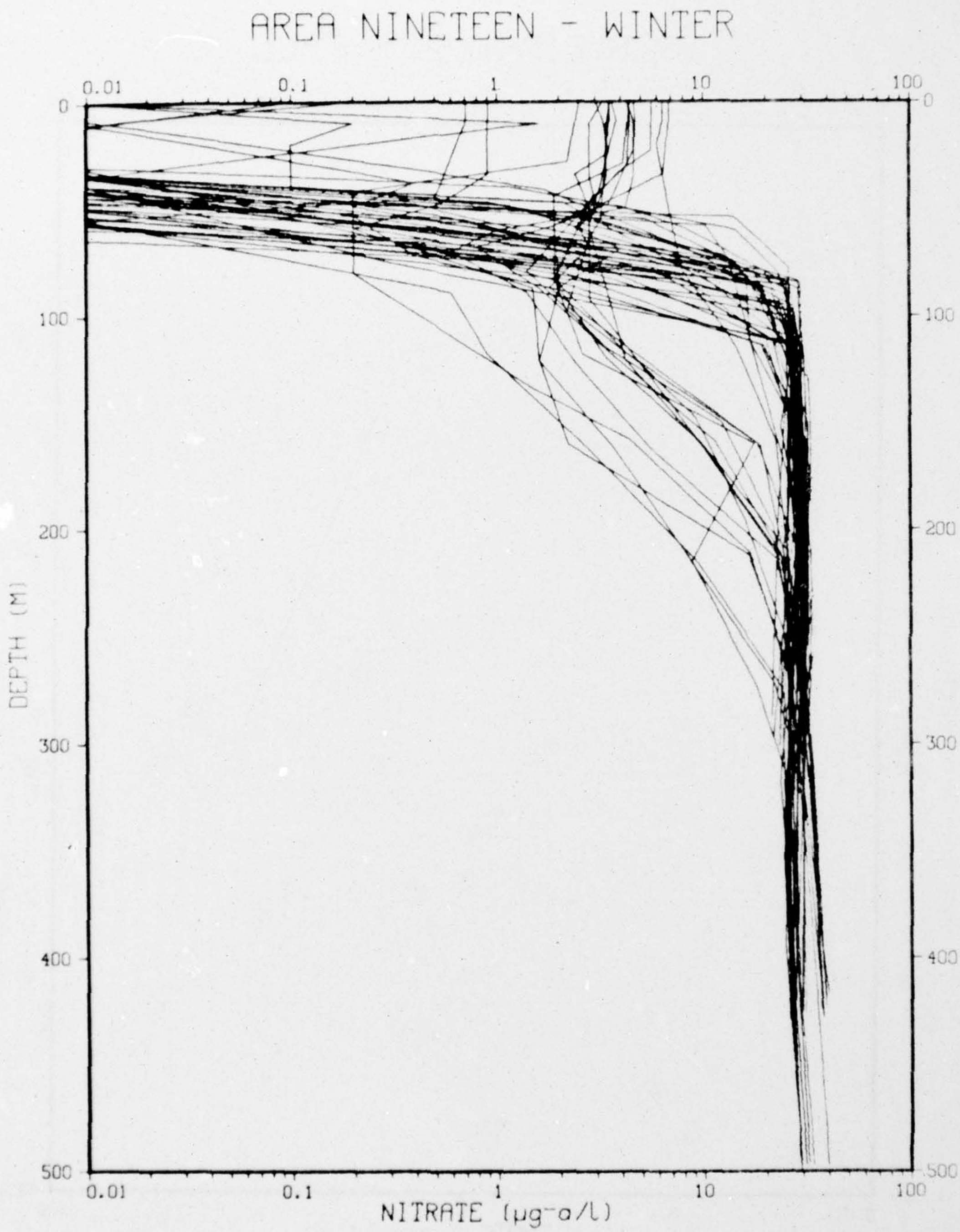

AREA NINETEEN - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.16.

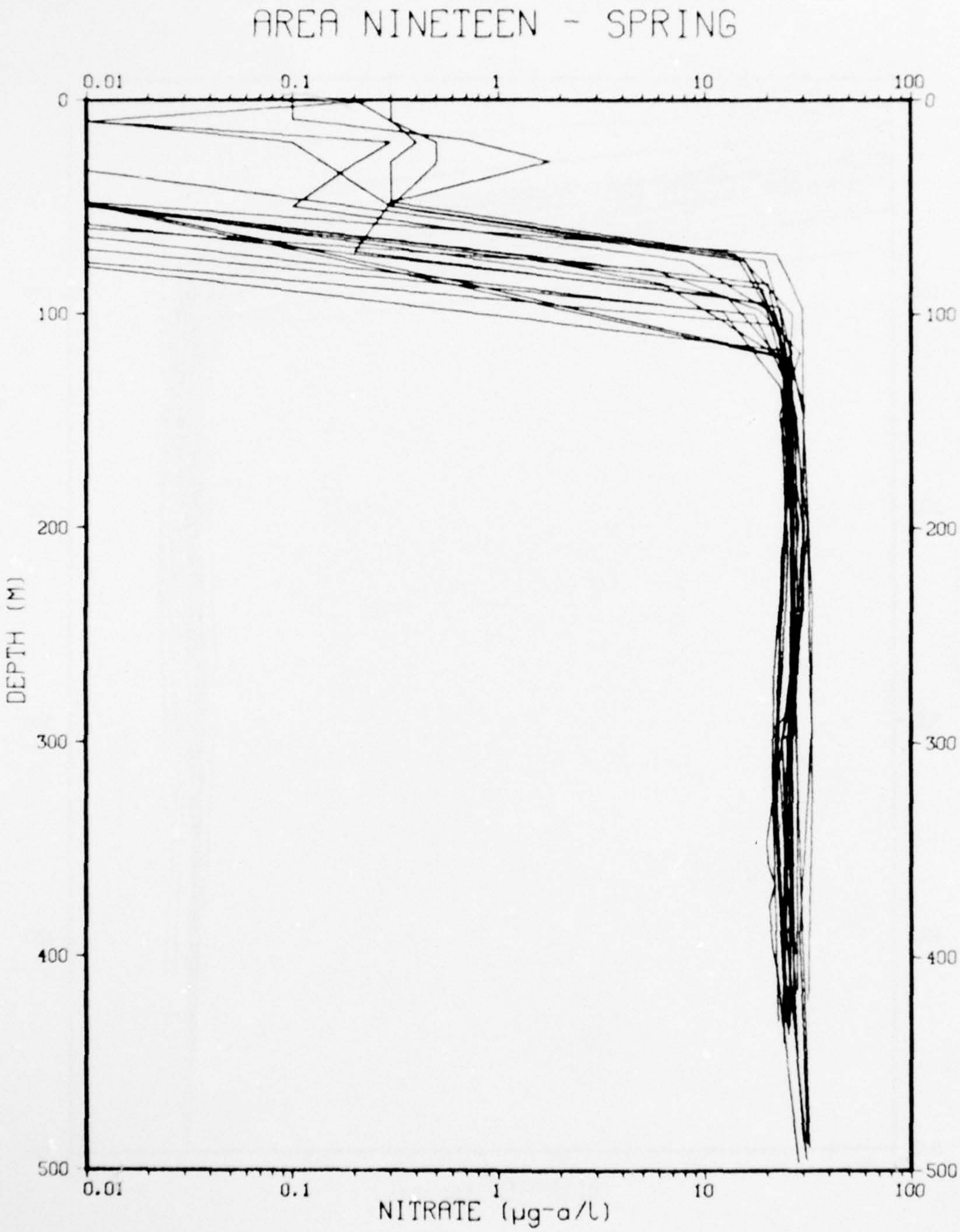

AREA NINETEEN - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.17.

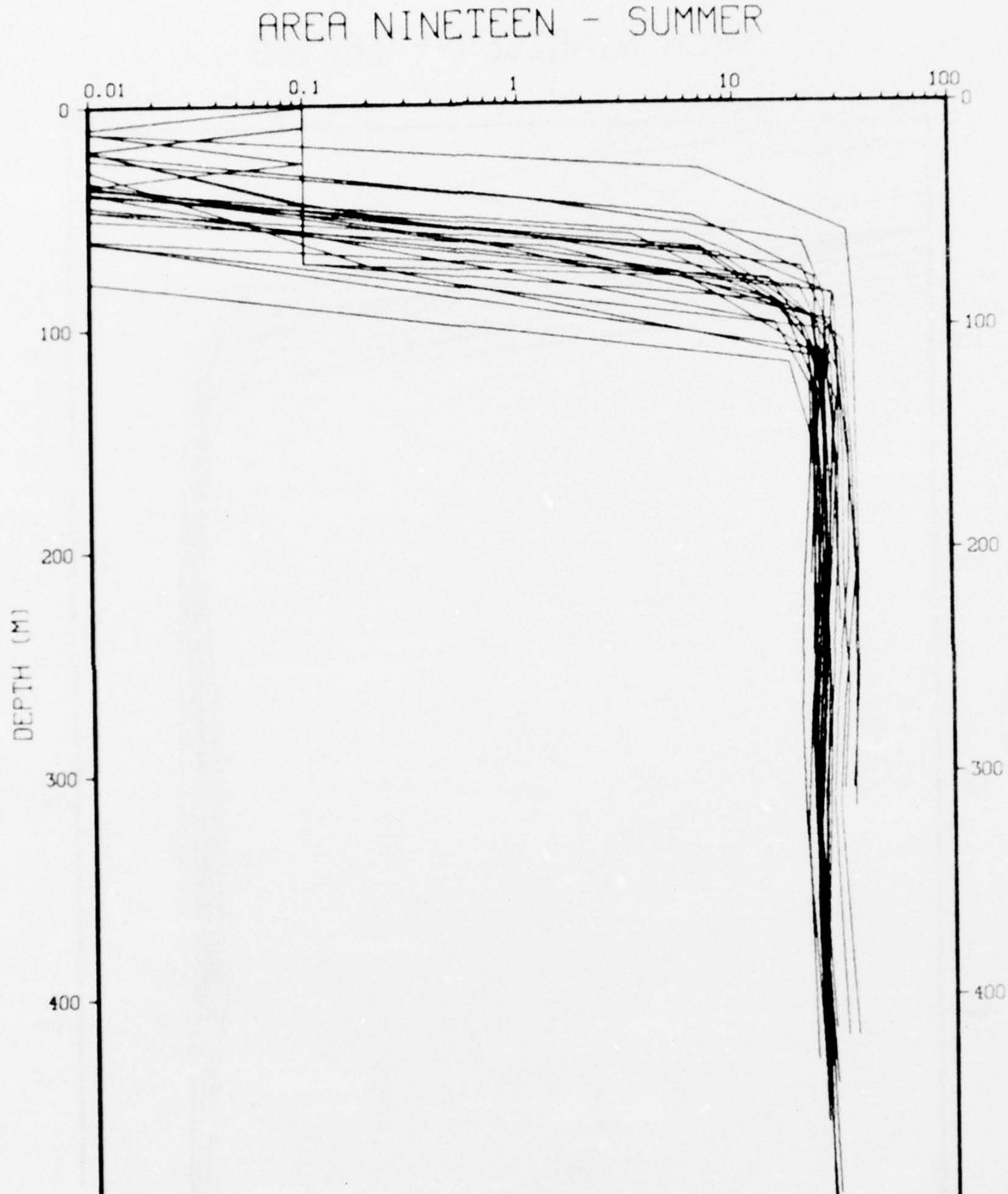

AREA NINETEEN - SUMMER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (μg-a/l)

Figure A.18.

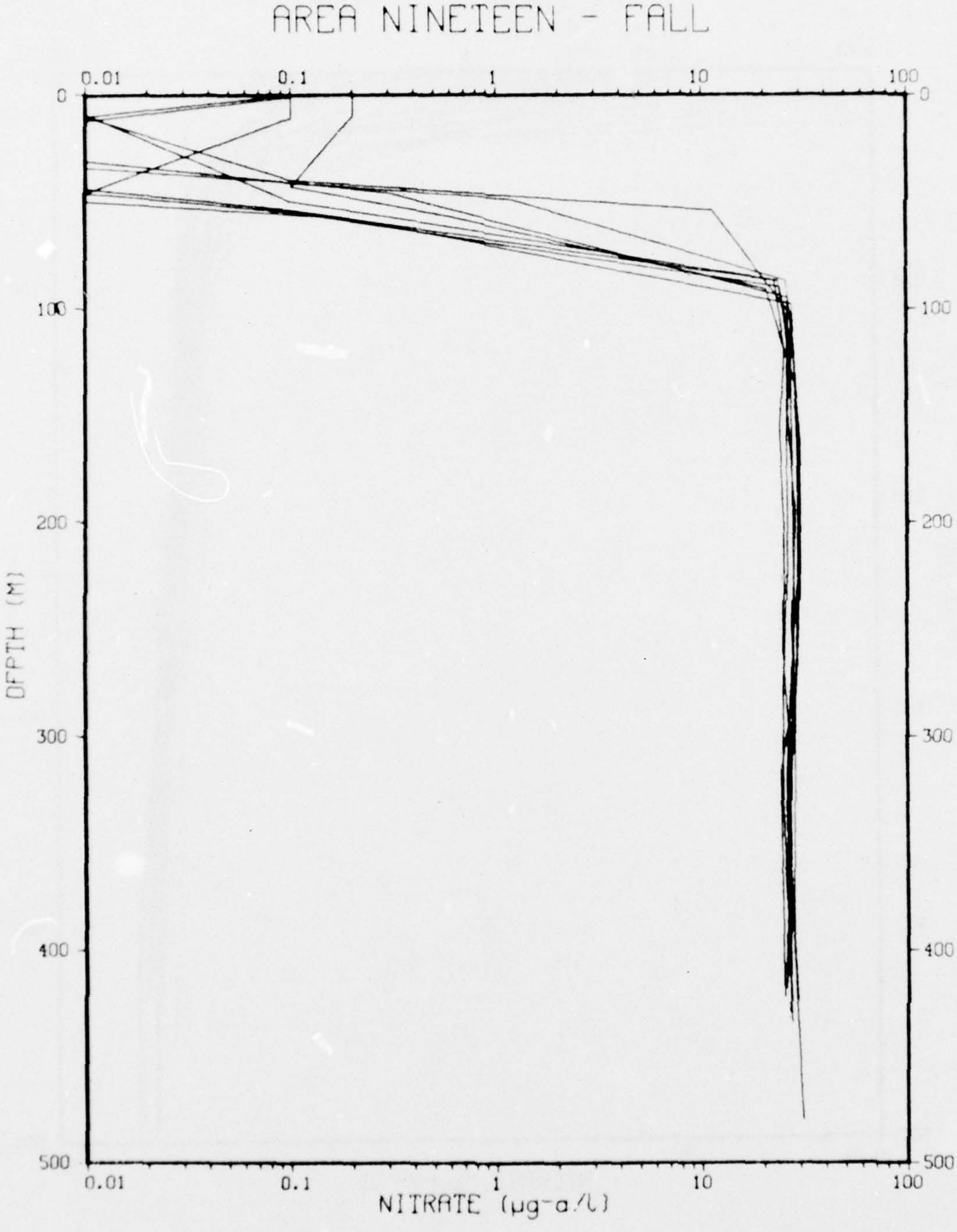

AREA NINETEEN - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/l)

Figure A.19.

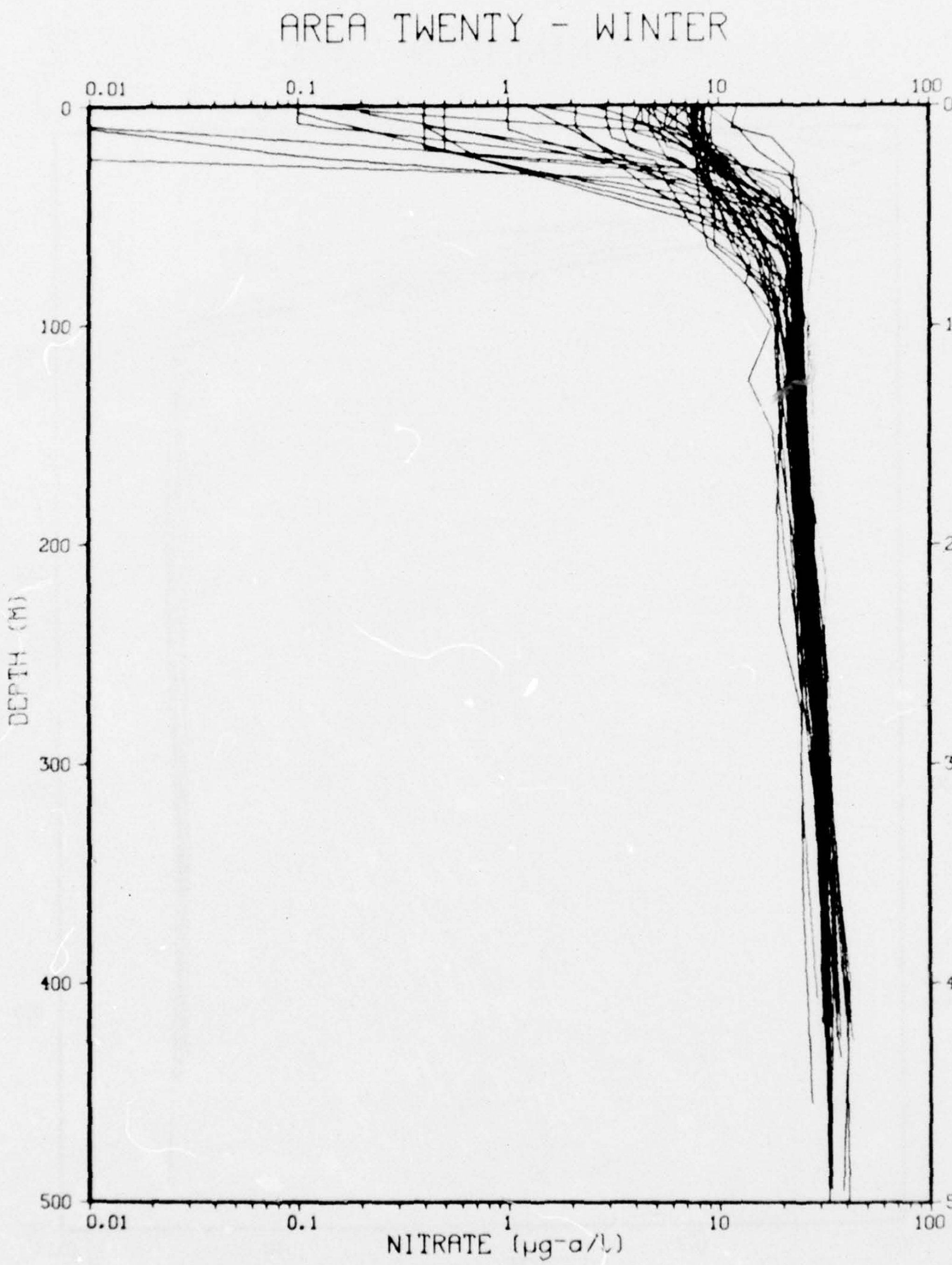
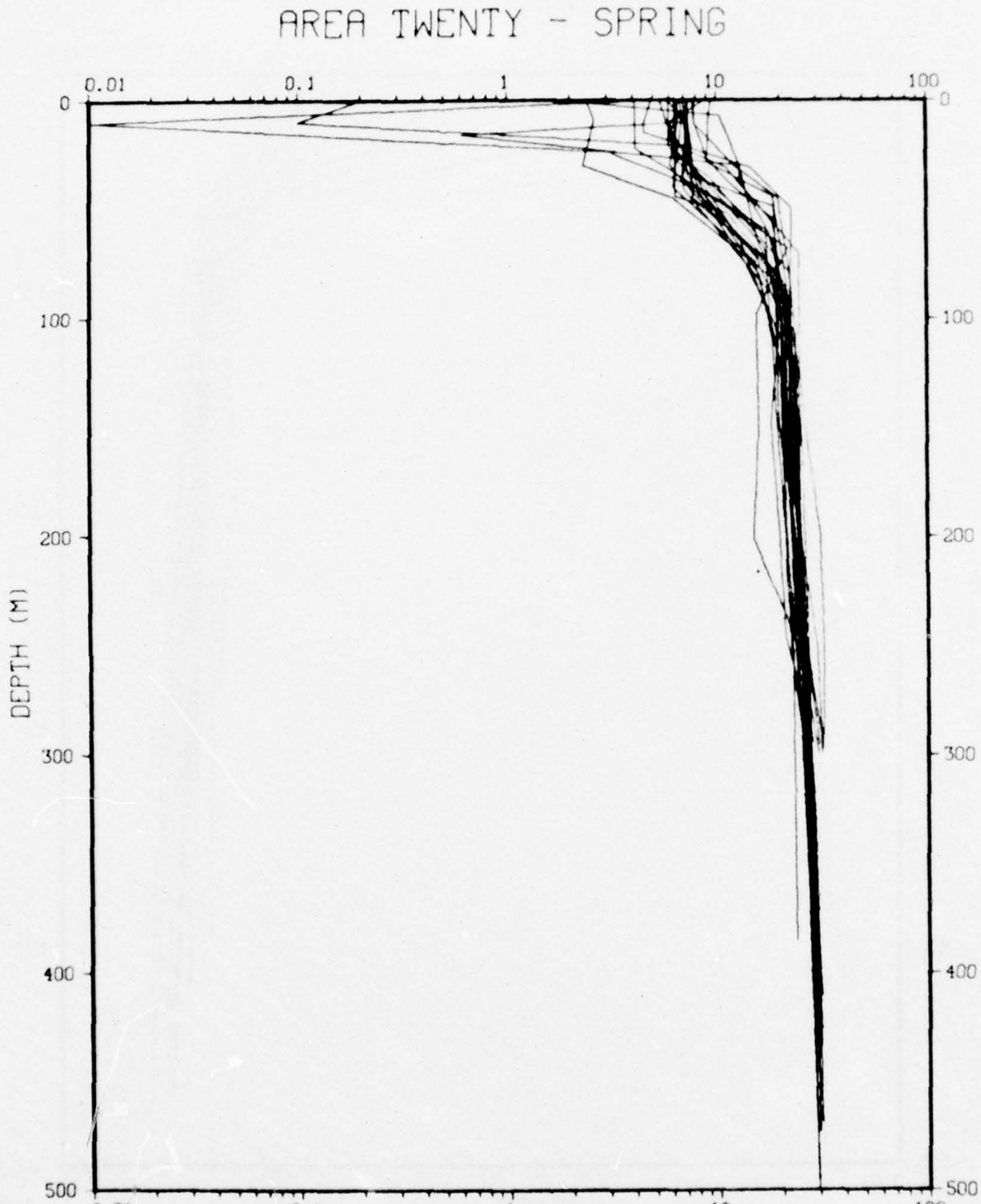

AREA TWENTY - WINTER
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/L)

Figure A.20.



AREA TWENTY - SPRING
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-c/l)

Figure A.21.

AREA TWENTY - SUMMER

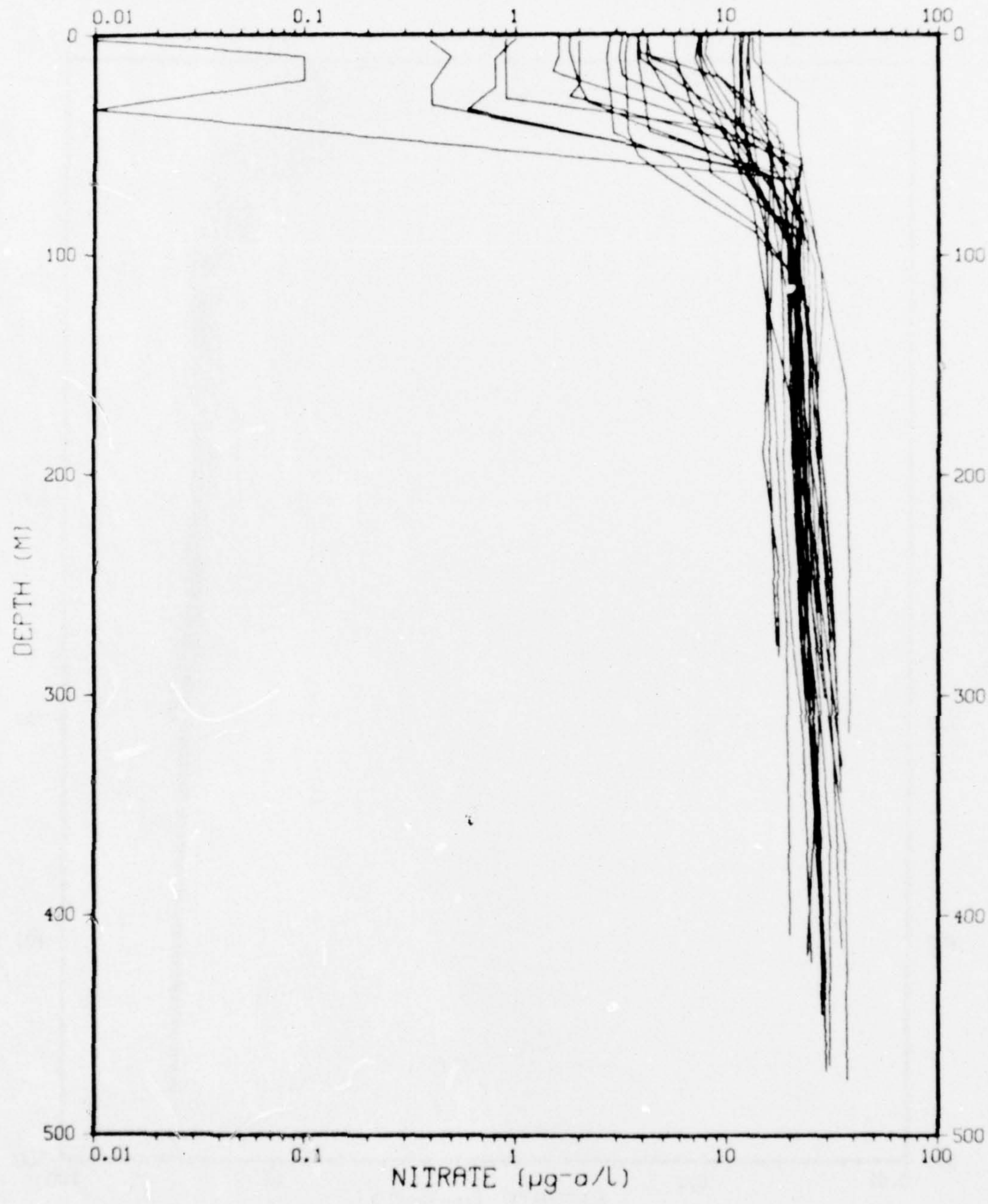


Figure A.22.

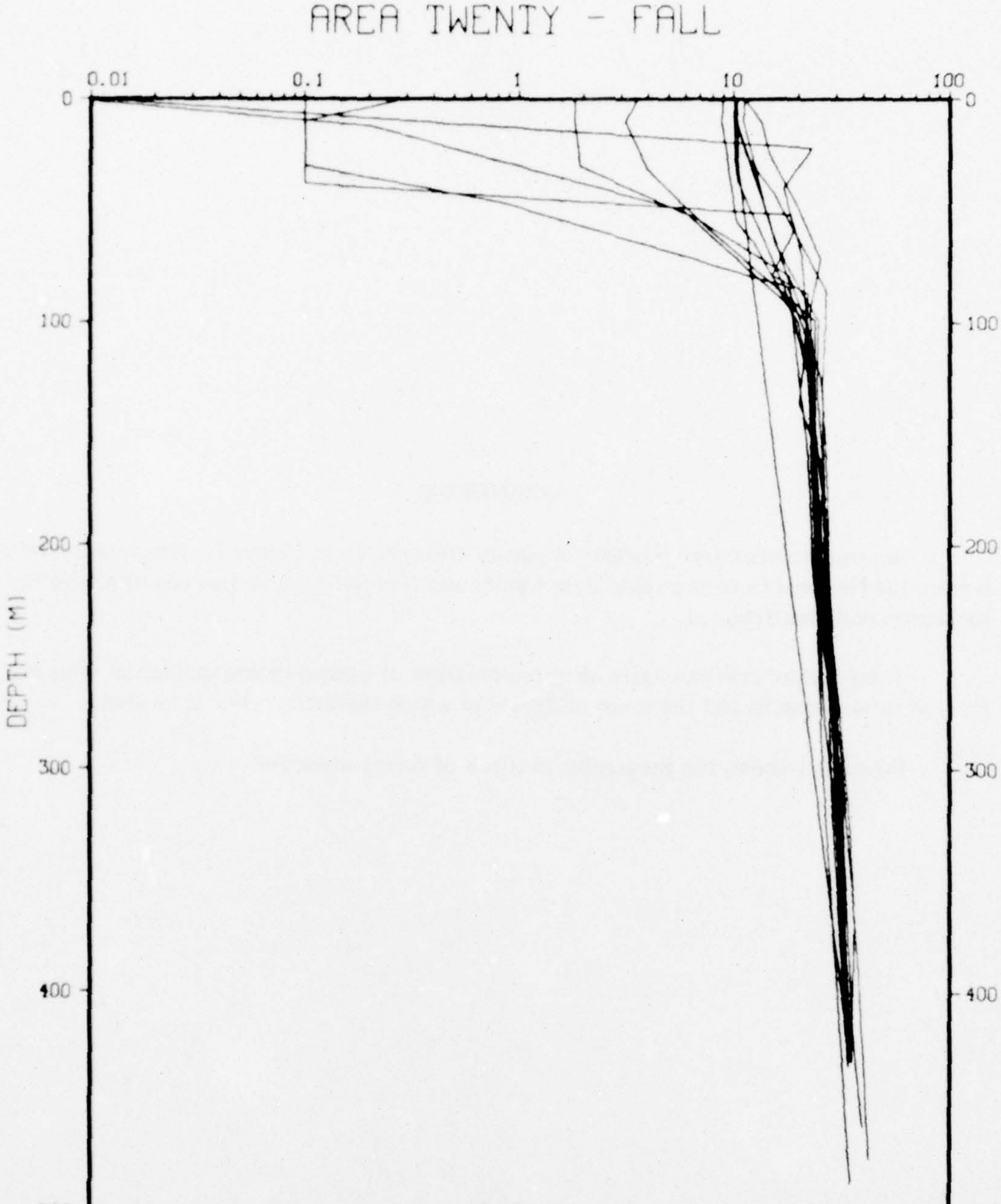

AREA TWENTY - FALL
0.01
0.1
1
10
100
0
100
200
300
400
500
DEPTH (M)
NITRATE (µg-a/L)

Figure A.23.

APPENDIX B

Seasonal temperature profiles for survey areas shown in Figure 1. Temperature data is from the National Oceanographic Data Center and represents all hydrocasts of record for the season and area depicted.

Temperature envelopes give an approximation of minimum and maximum temperatures at various depths and the range of depths at which the thermocline is located.

Figure B.1 shows the geographic location of survey areas 1-9.

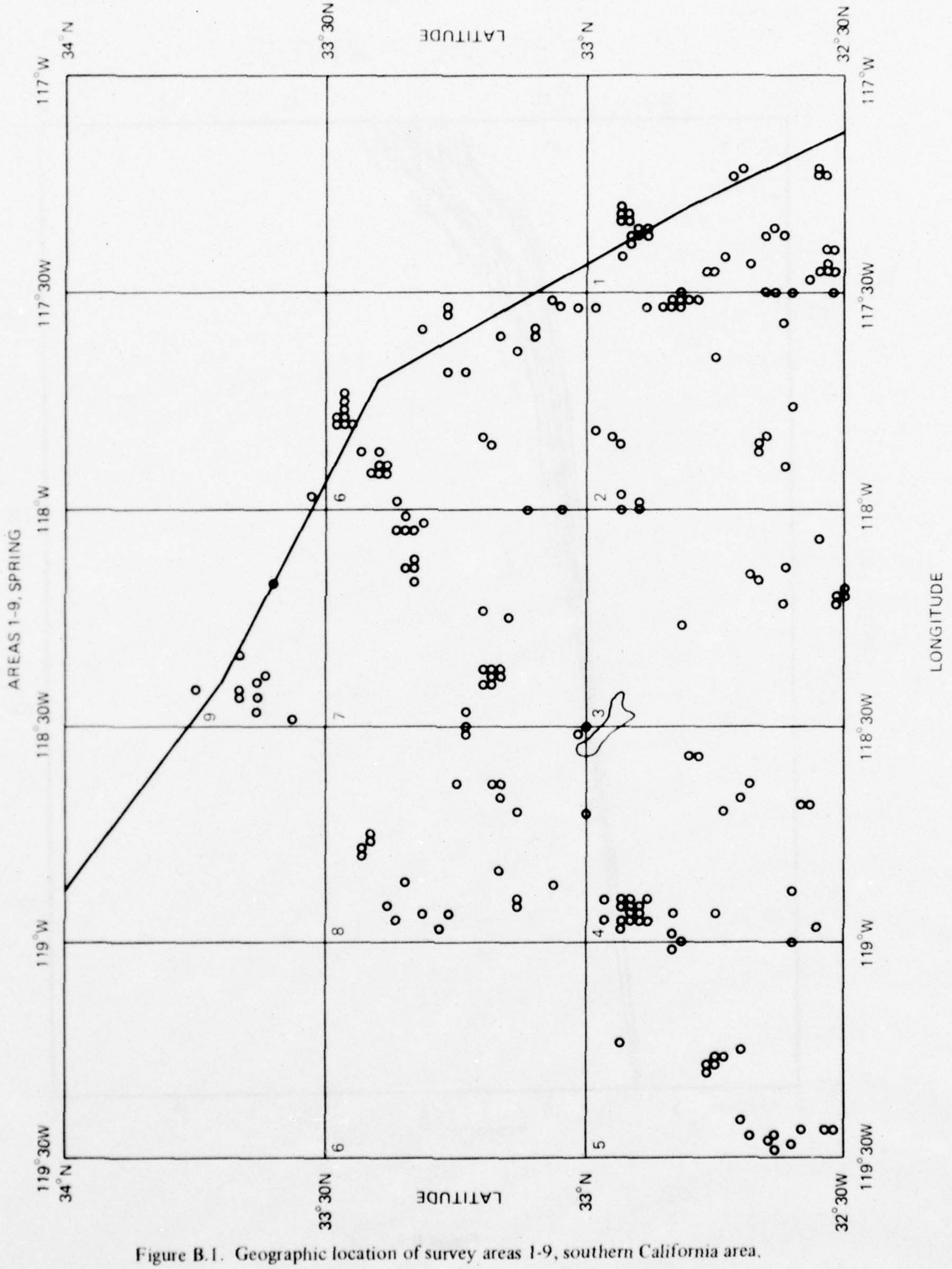


Figure B.1. Geographic location of survey areas 1-9, southern California area.

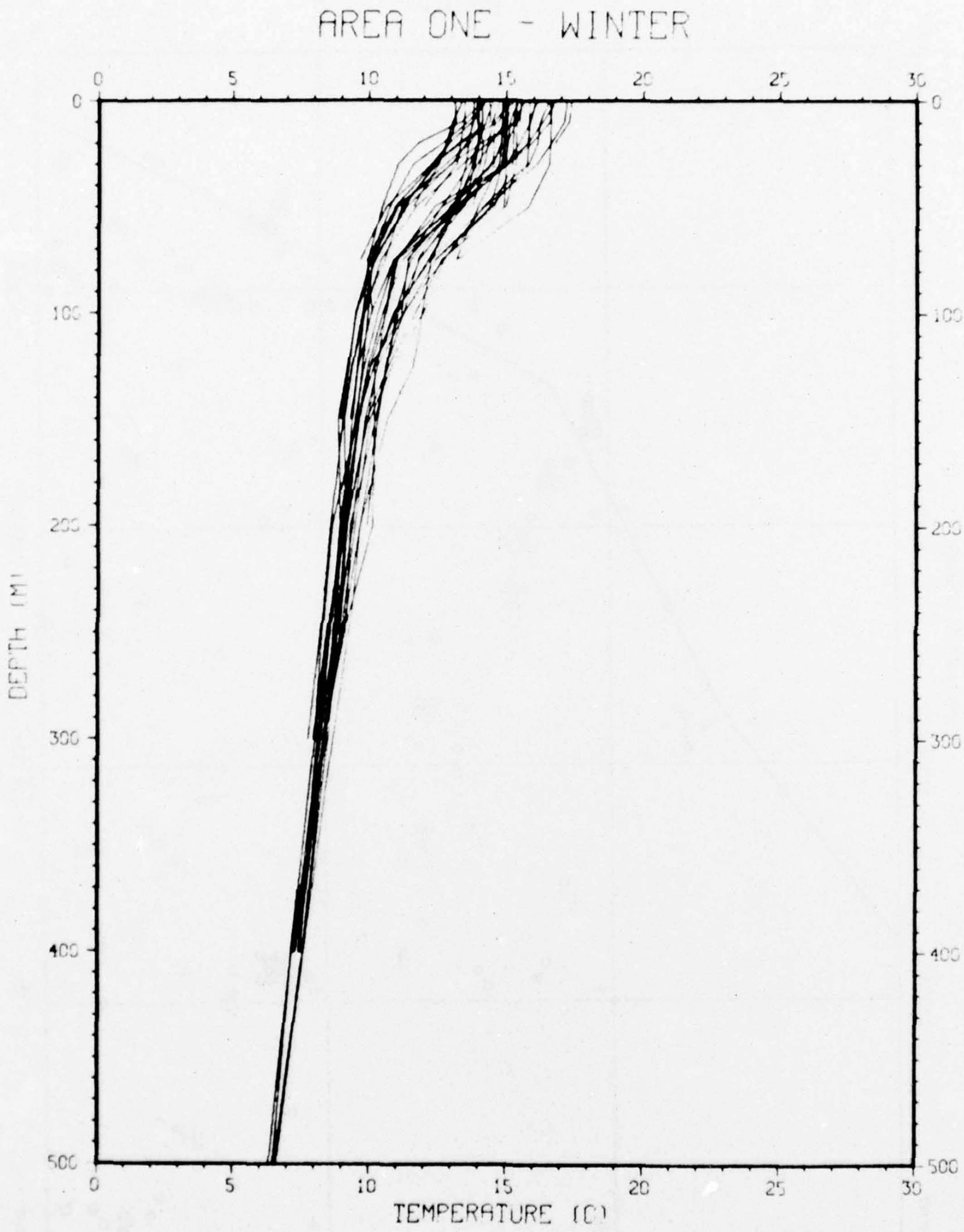

AREA ONE - WINTER
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.2.


AREA ONE - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.3.

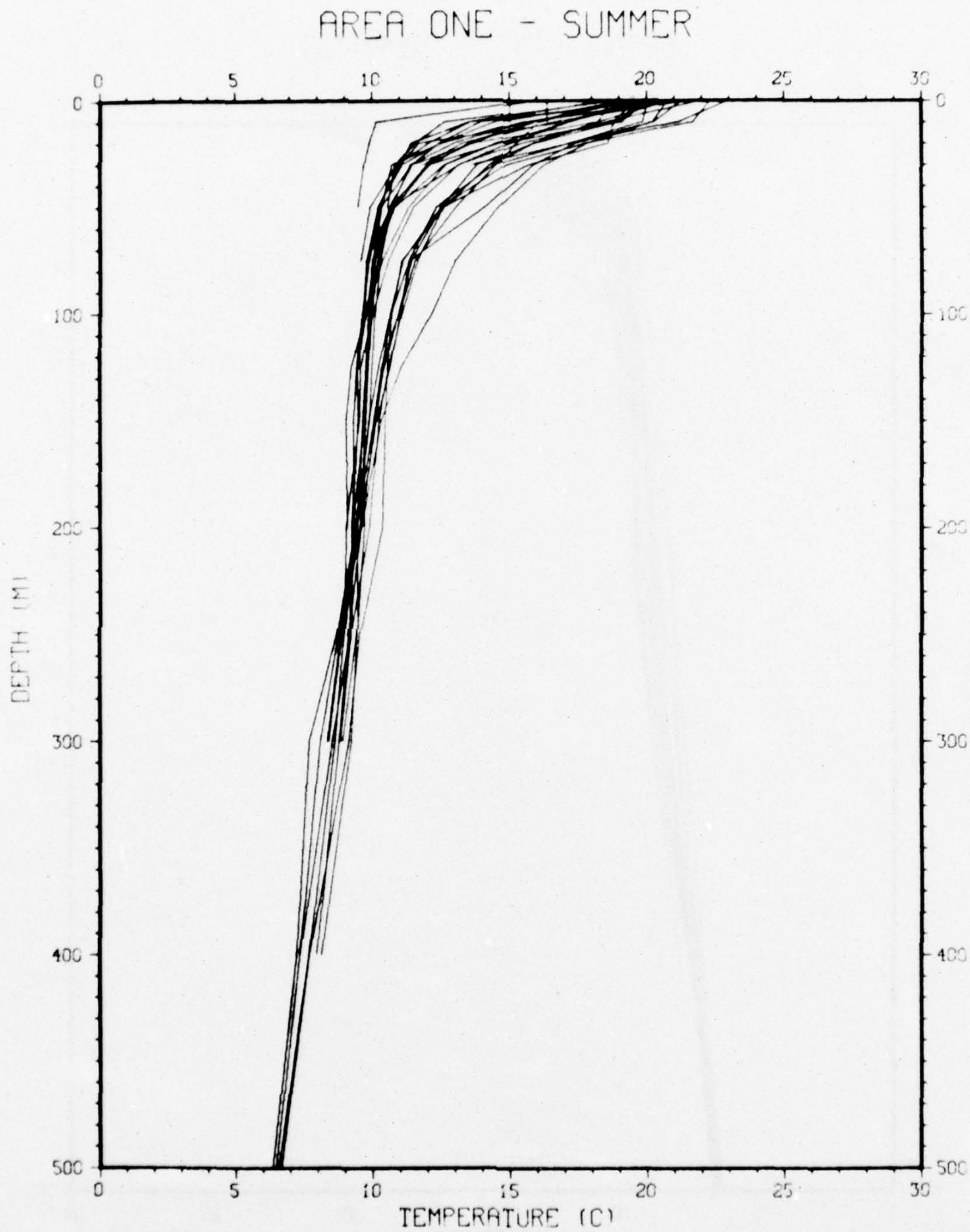

AREA ONE - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.4.

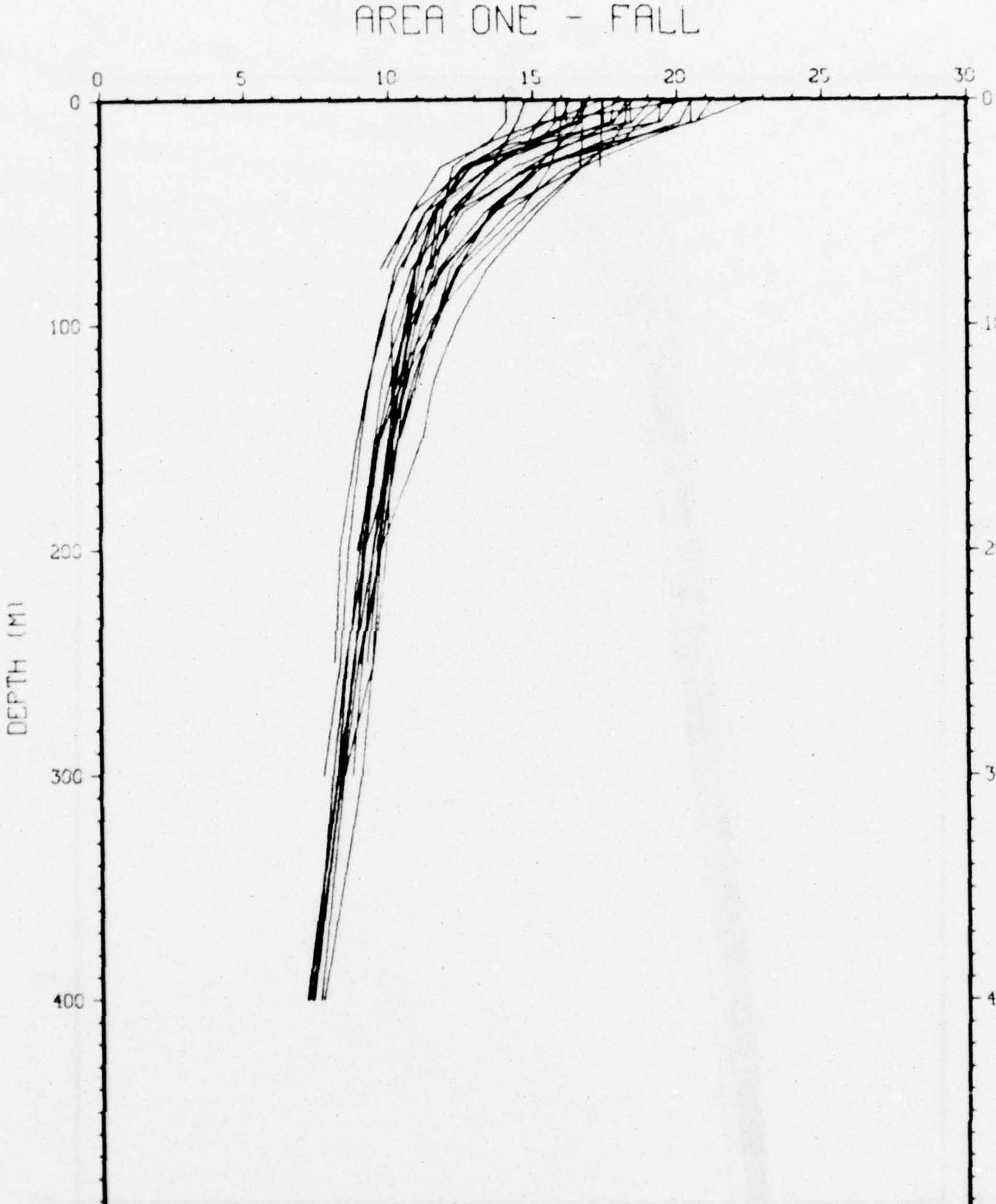

AREA ONE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.5.

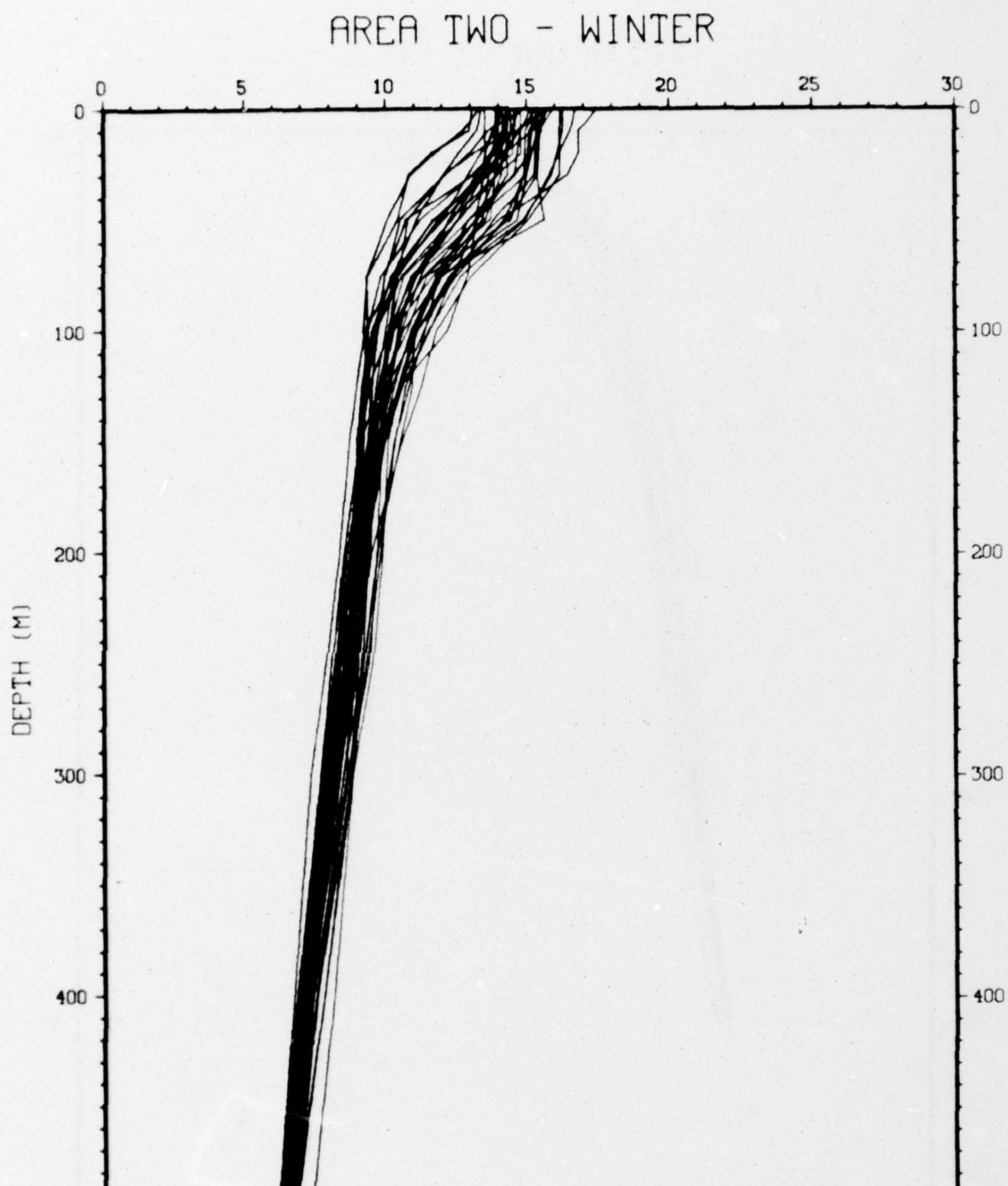

AREA TWO - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.6.

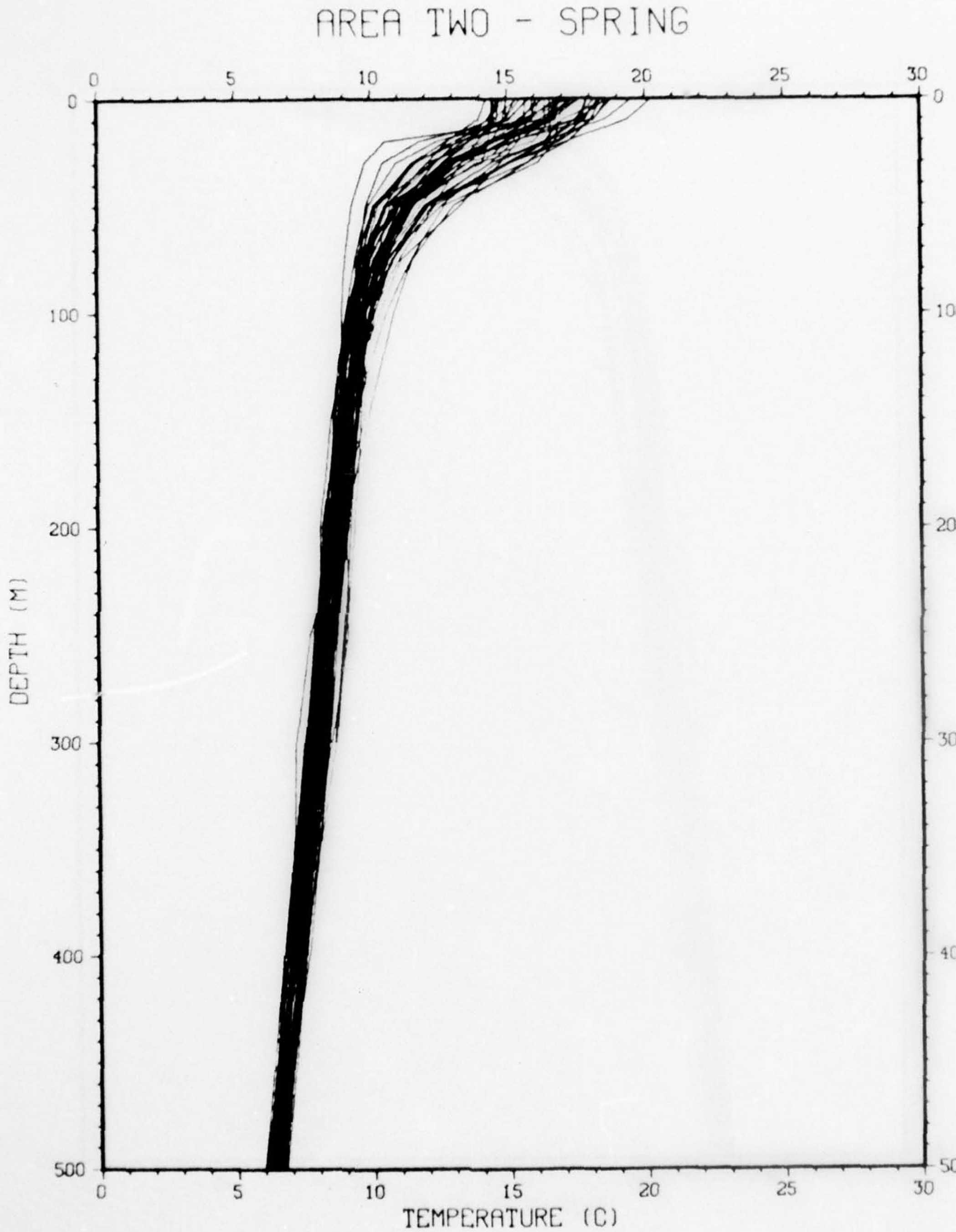

AREA TWO - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.7.

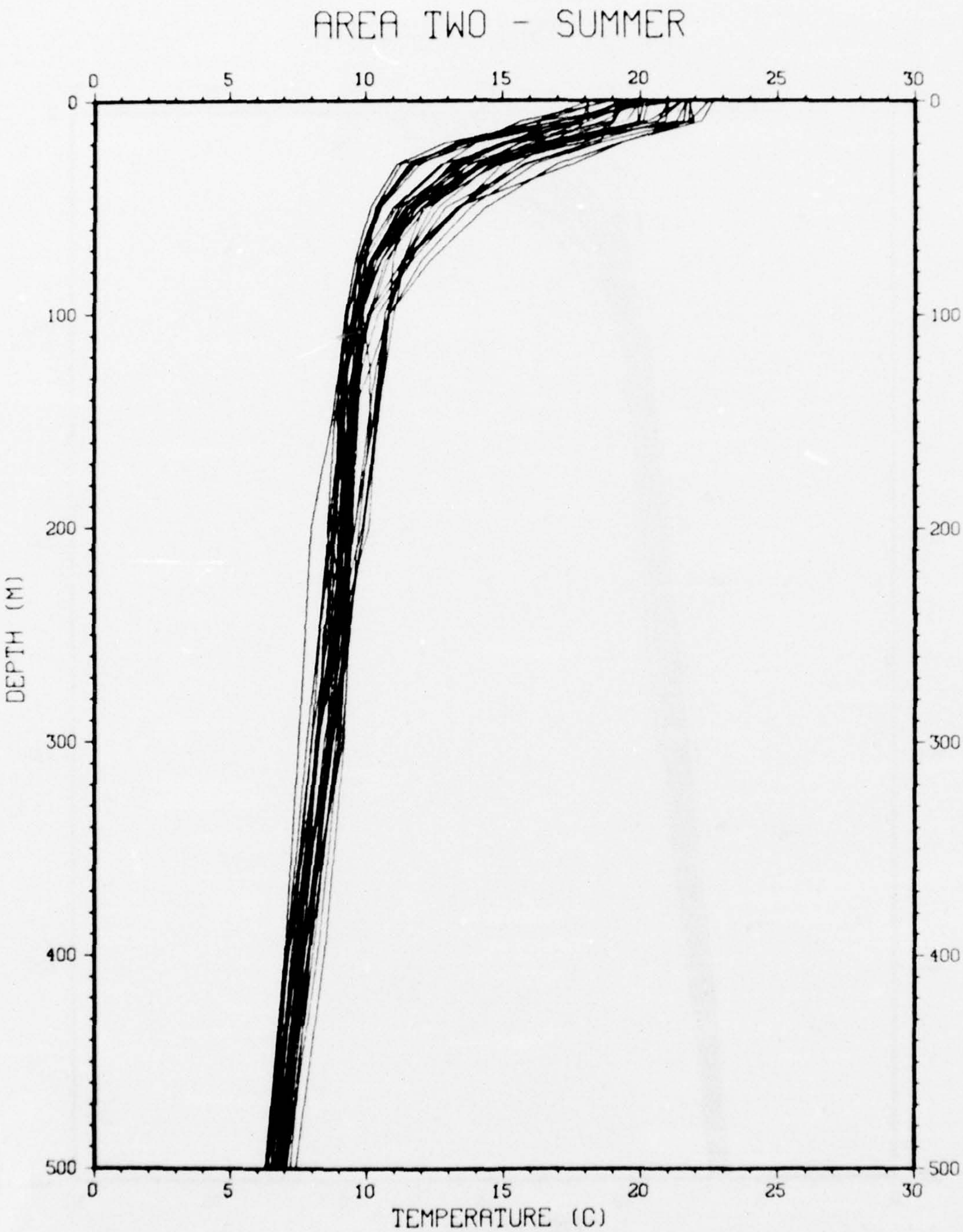

AREA TWO - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.8.

AREA TWO - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.9.

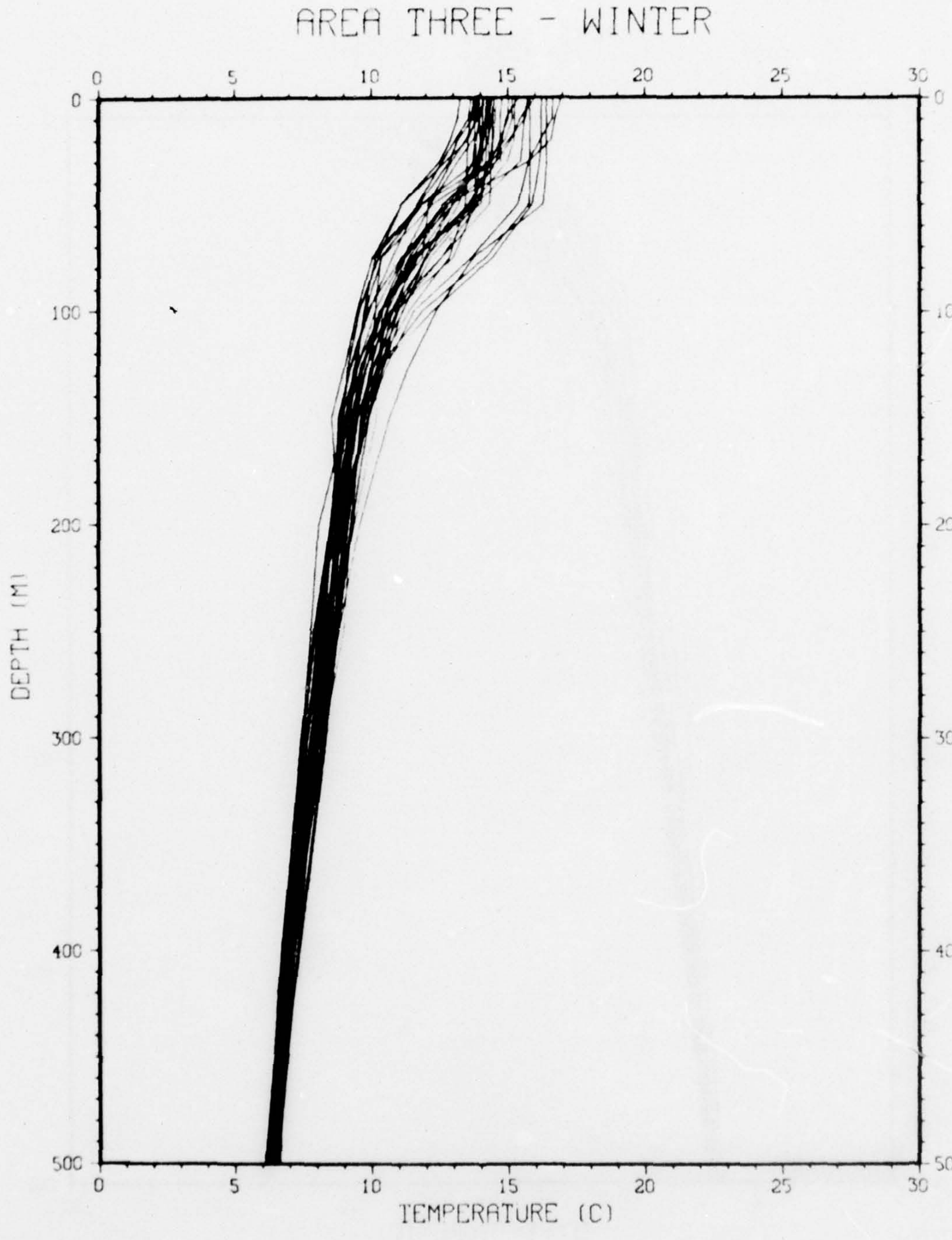

AREA THREE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.10.

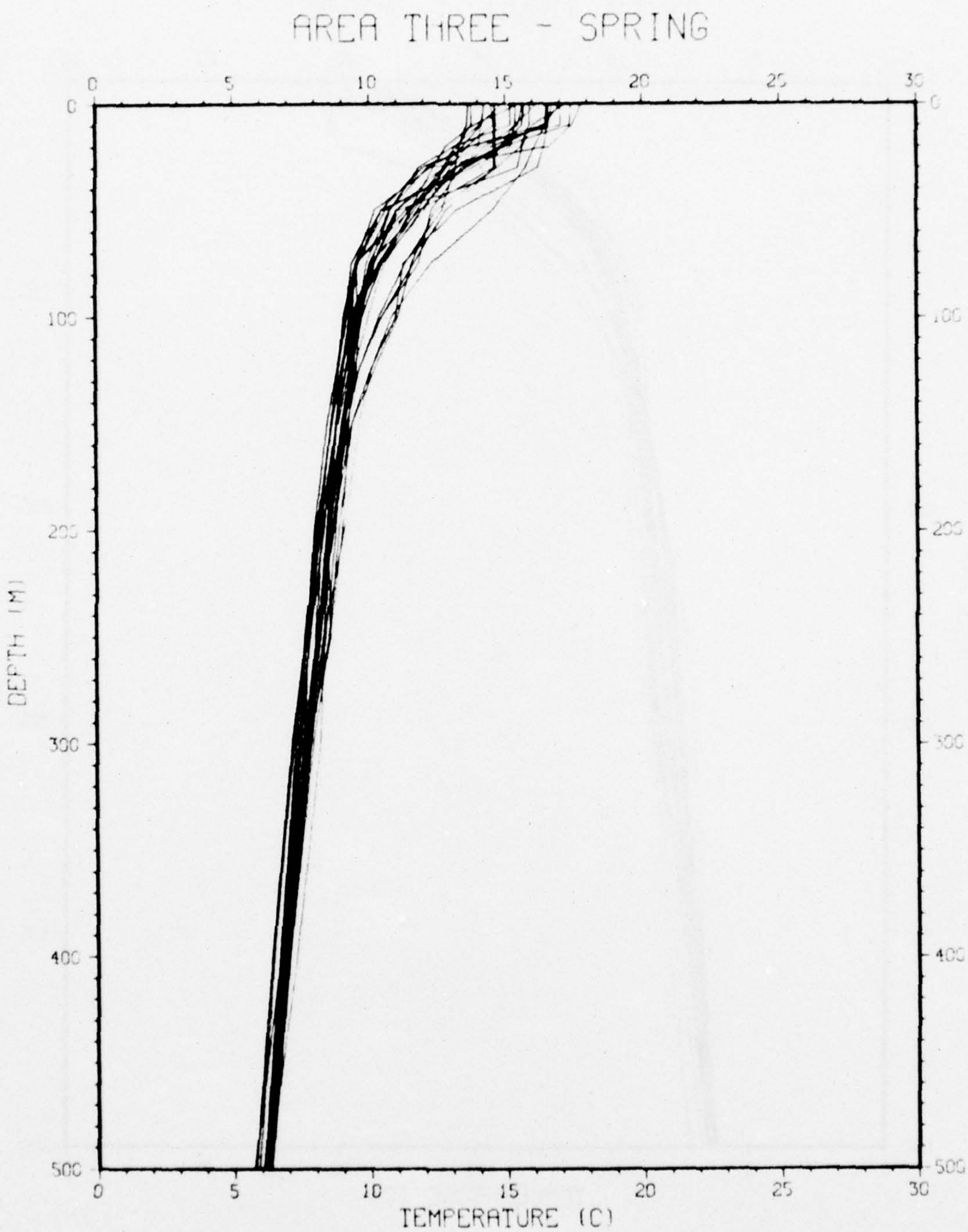

AREA THREE - SPRING
0
5
10
15
20
25
30
DEPTH (M)
100
200
300
400
500
TEMPERATURE (C)

Figure B.11.

AREA THREE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.12.

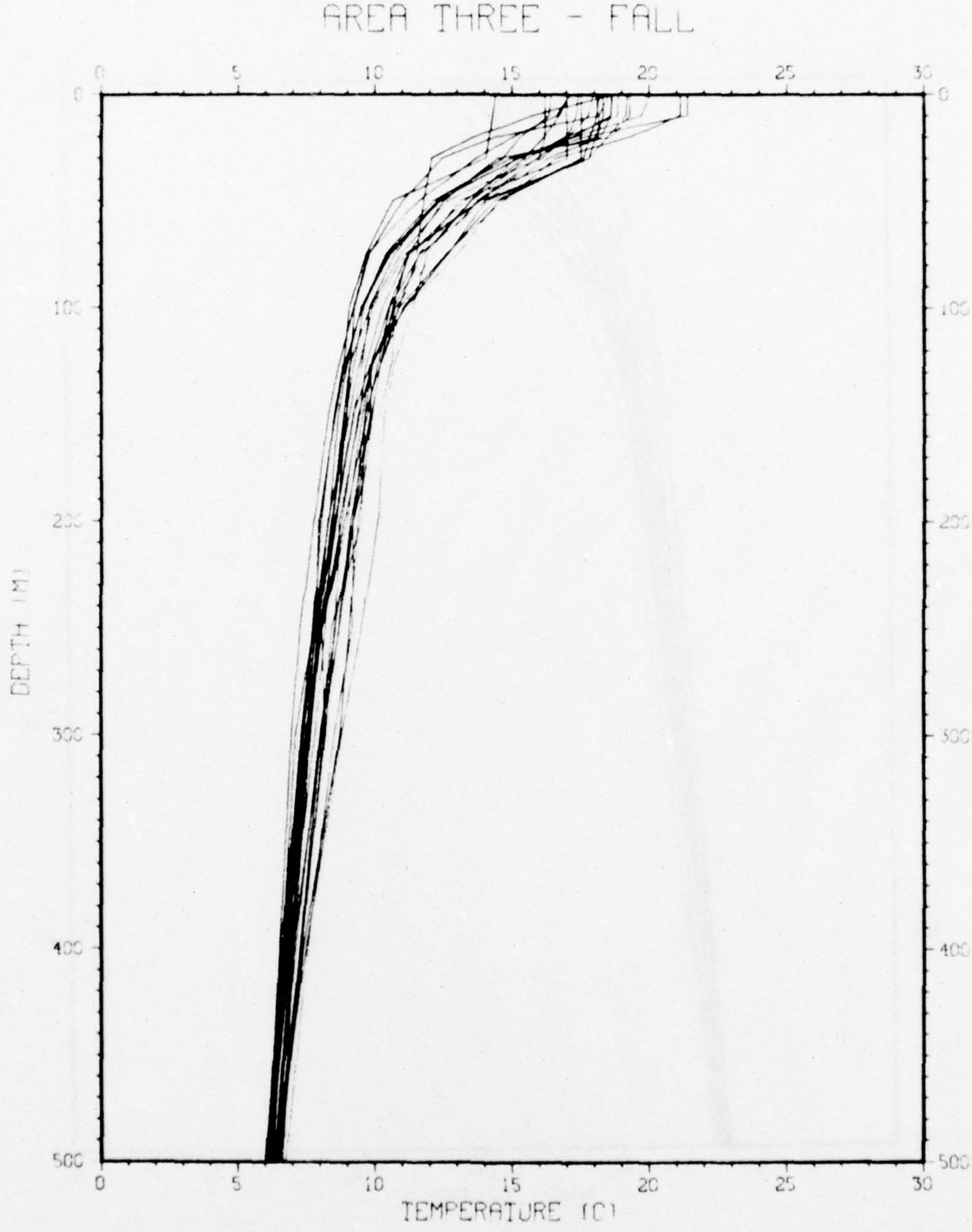
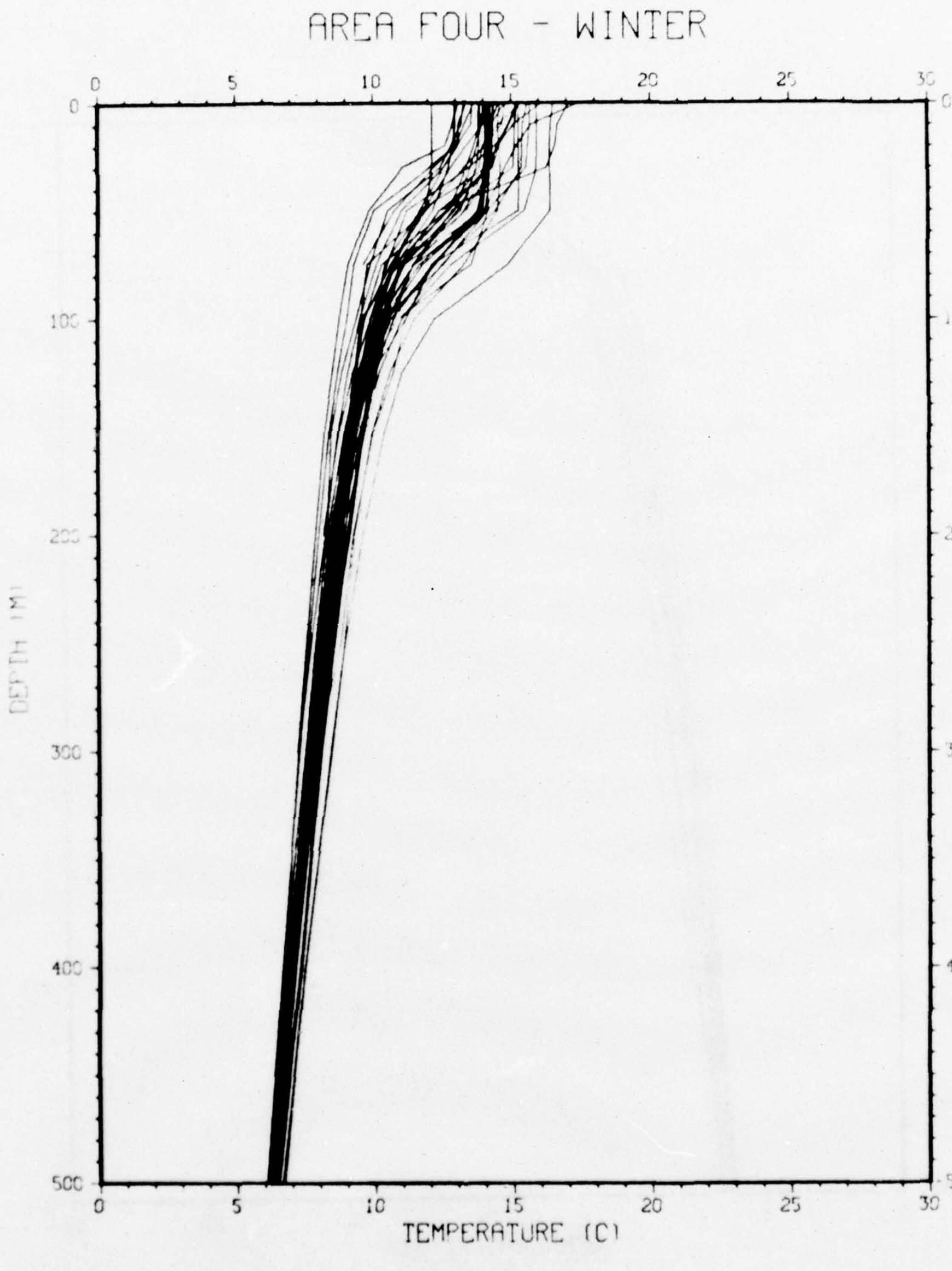

AREA THREE - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.13.



AREA FOUR - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.14.

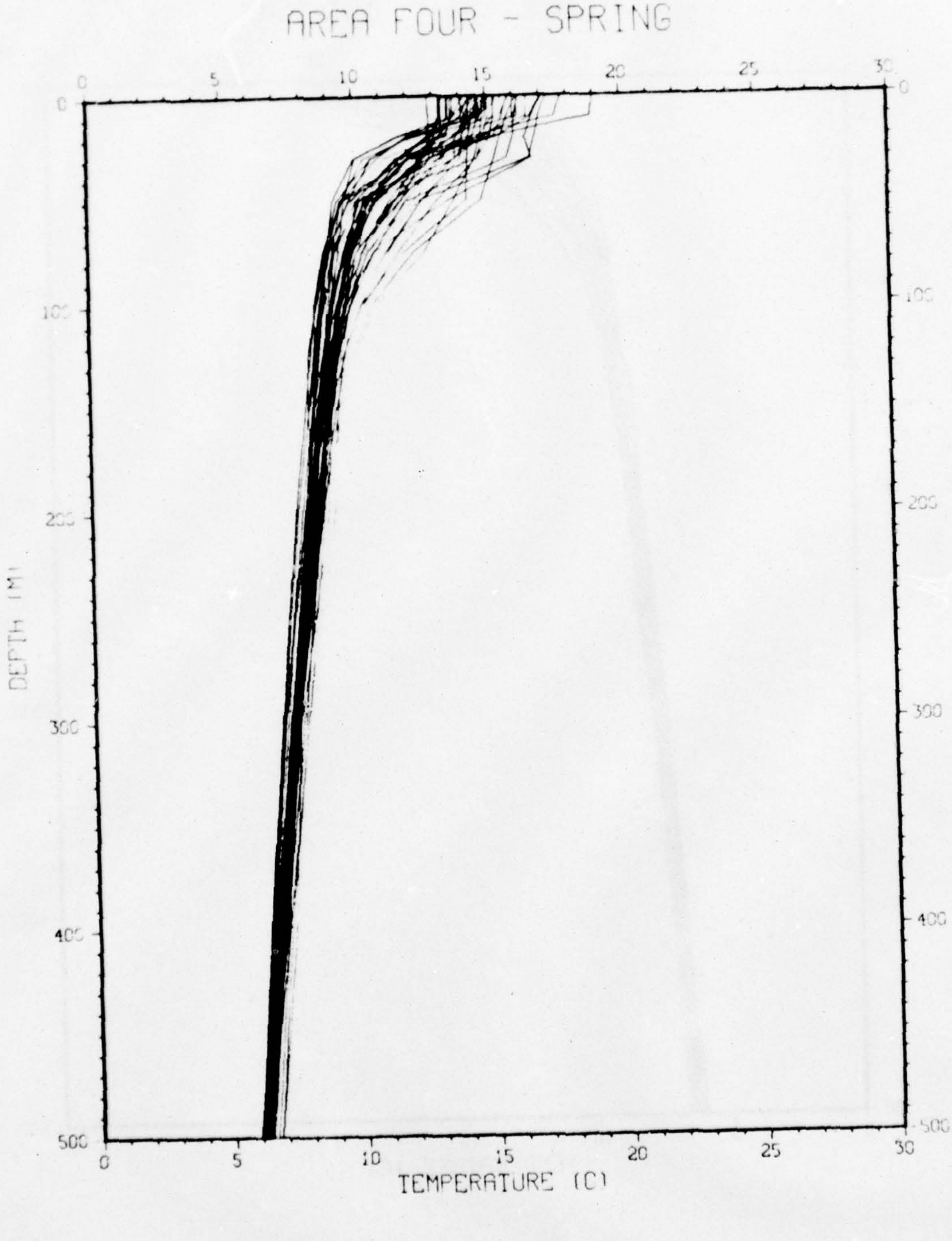

AREA FOUR - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.15.

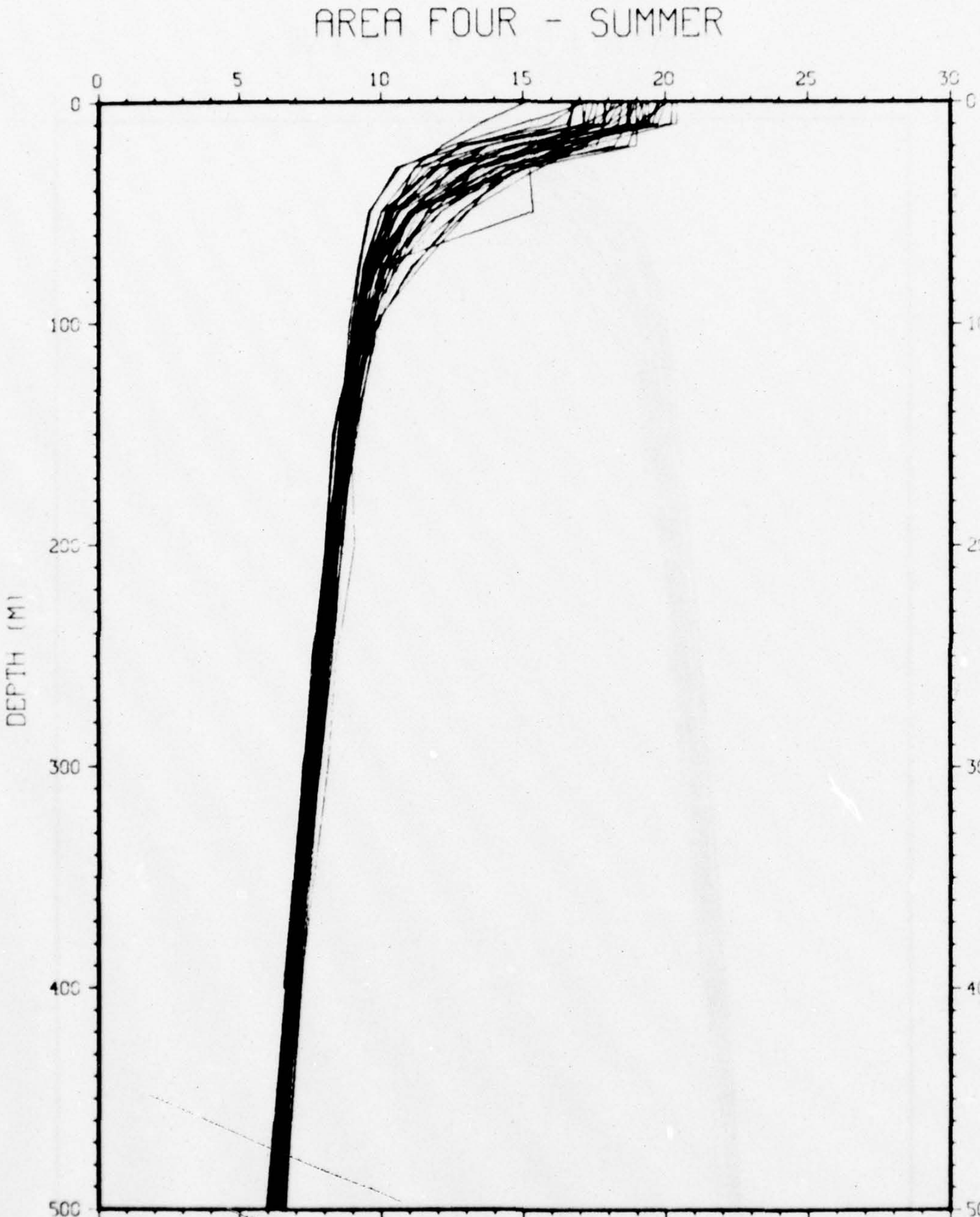

AREA FOUR - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.16.

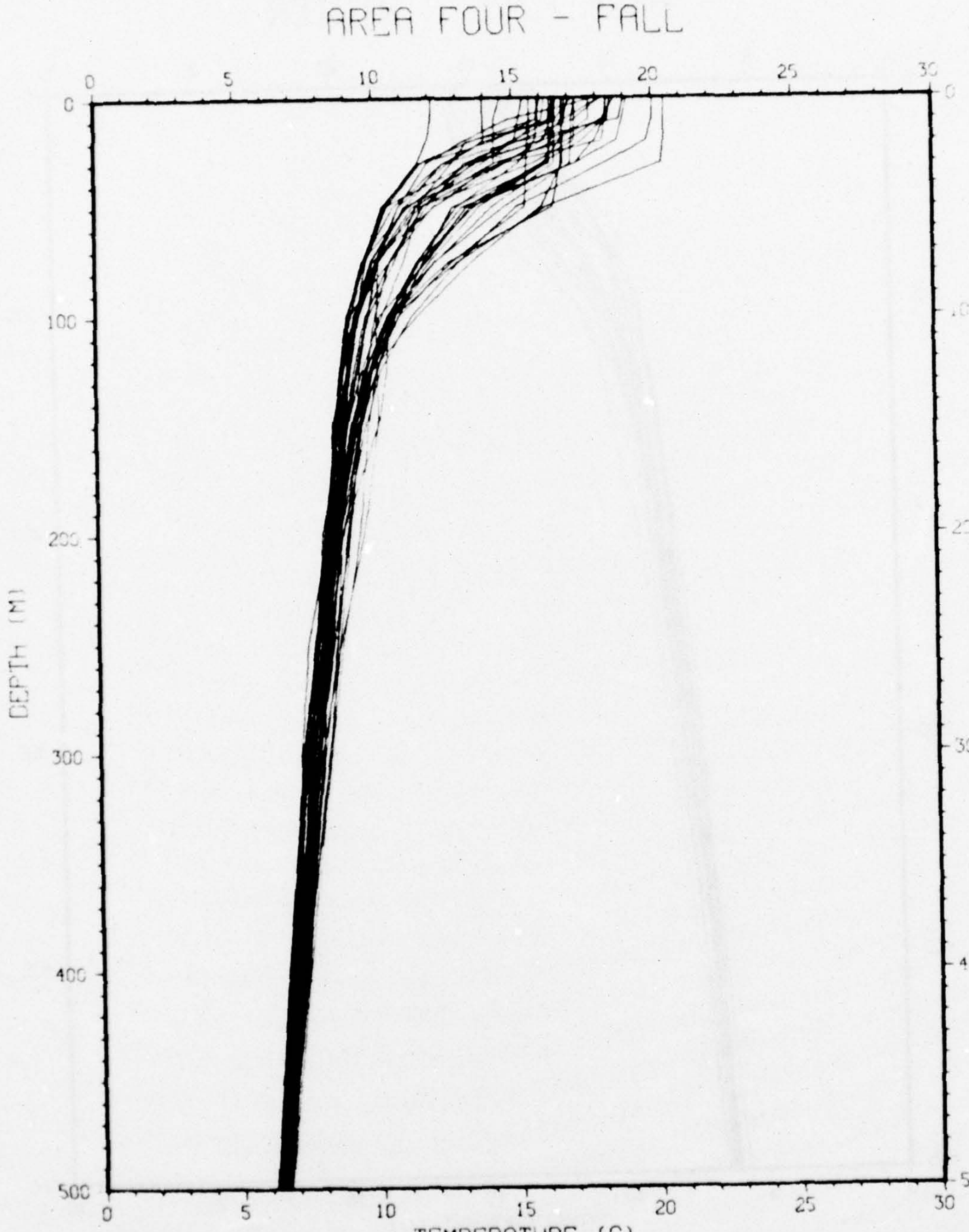

AREA FOUR - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.17.

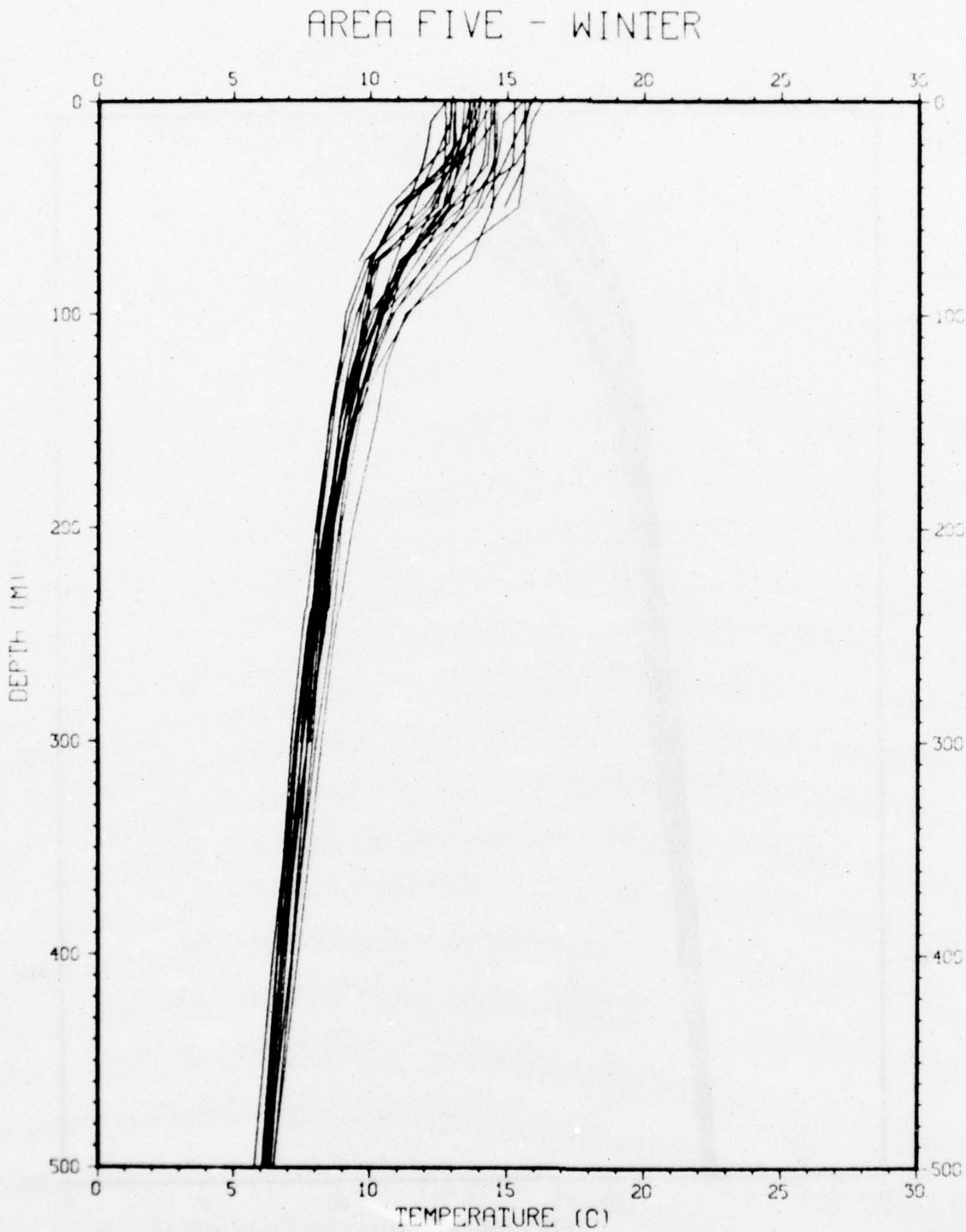
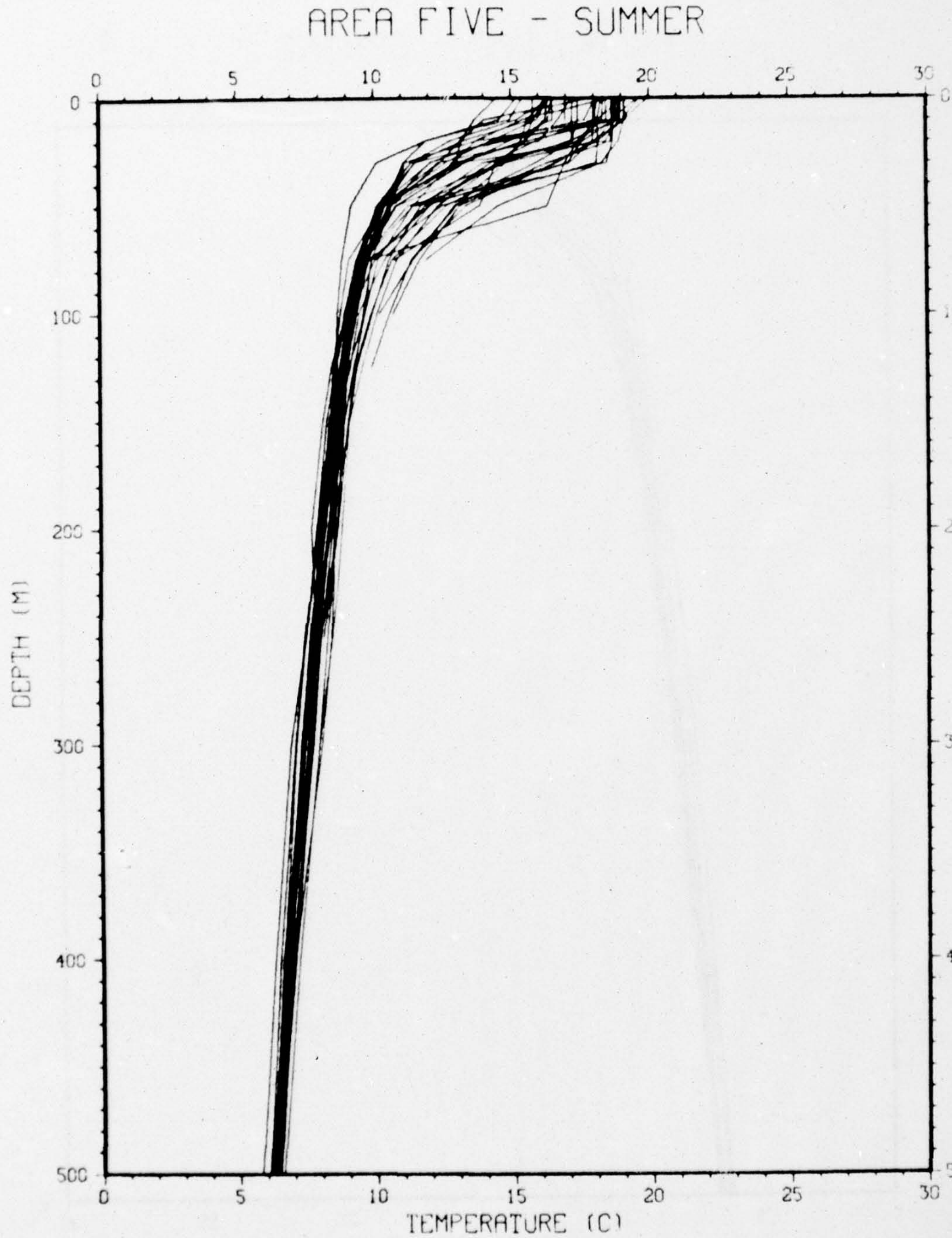

AREA FIVE - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.18.

AREA FIVE - SPRING
0
5
10
15
20
25
30
DEPTH (M)
100
200
300
400
500
TEMPERATURE (C)

Figure B.19.



AREA FIVE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.20.

AREA FIVE - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.21.

AREA SIX - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.22.


AREA SIX - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.23.

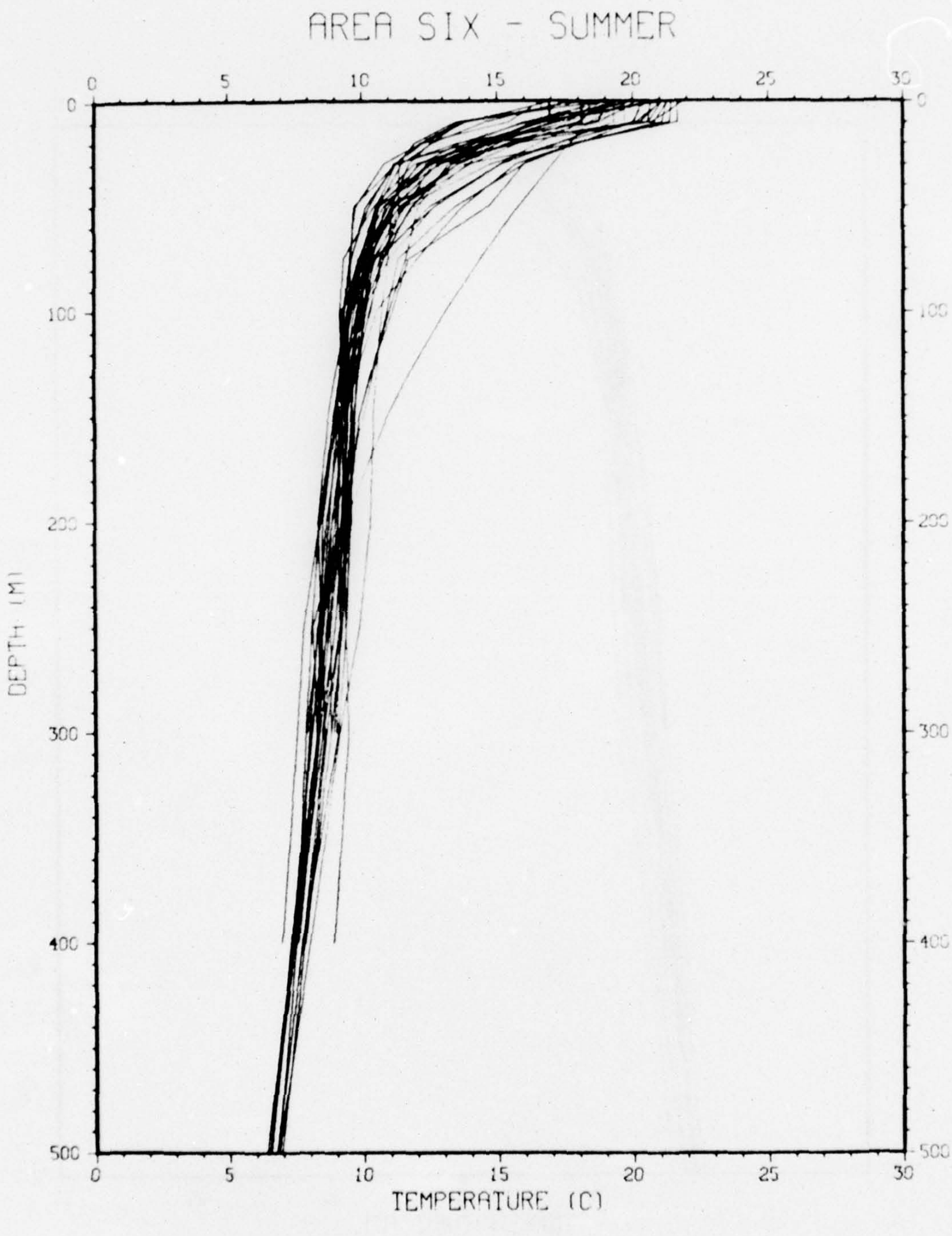

AREA SIX - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.24.

AREA SIX - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.25.


AREA SEVEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.26.

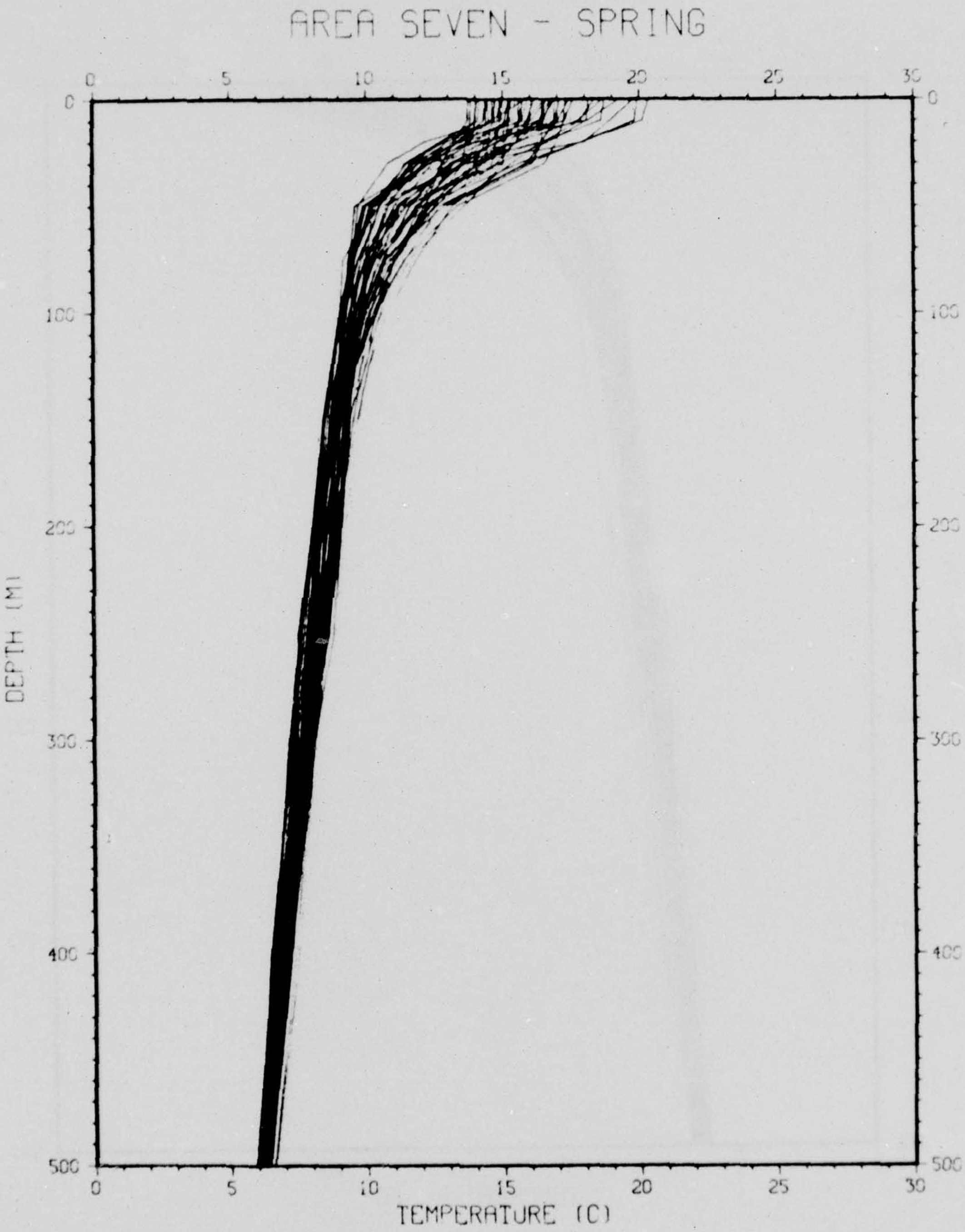

AREA SEVEN - SPRING
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.27.

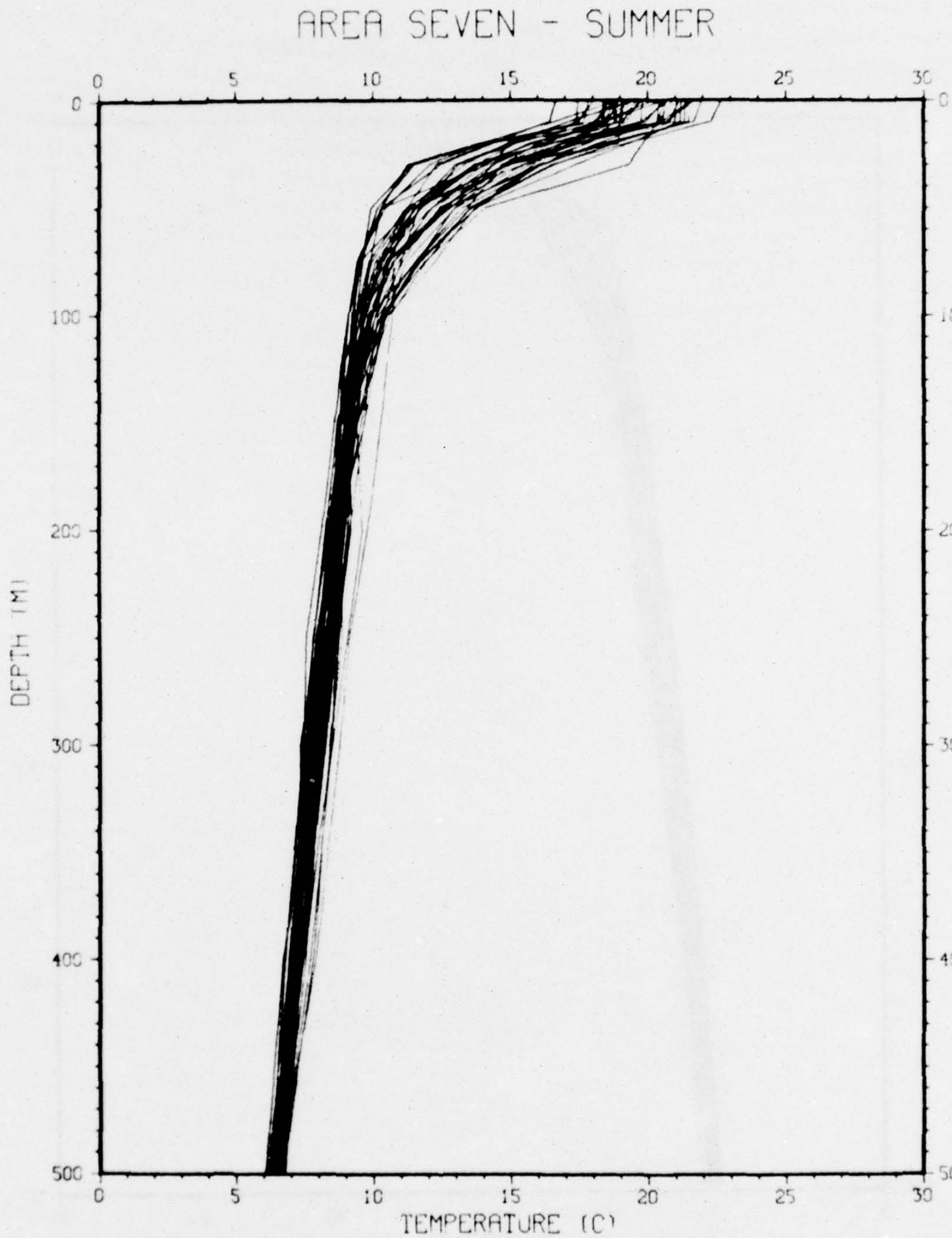
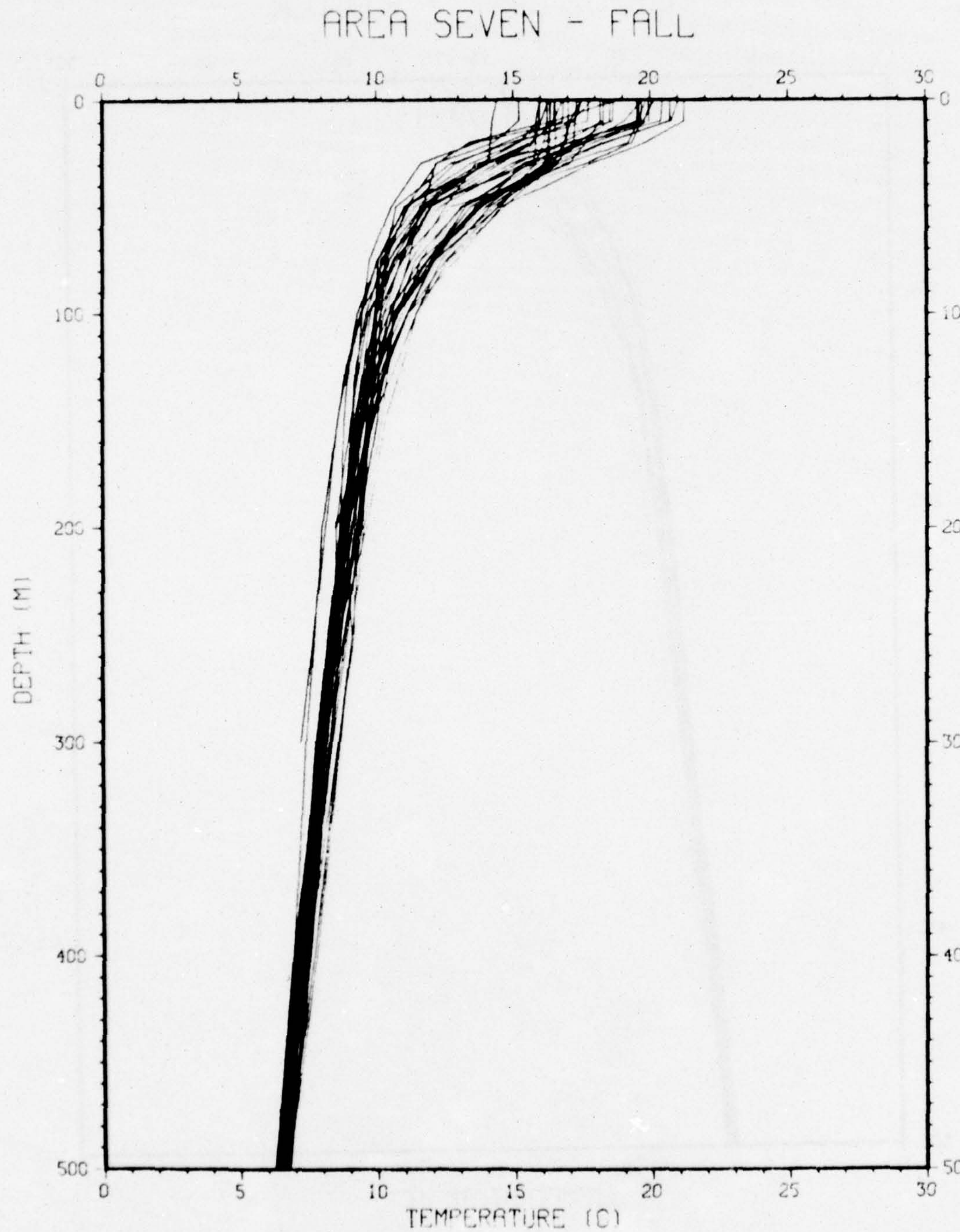

AREA SEVEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.28.



AREA SEVEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.29.

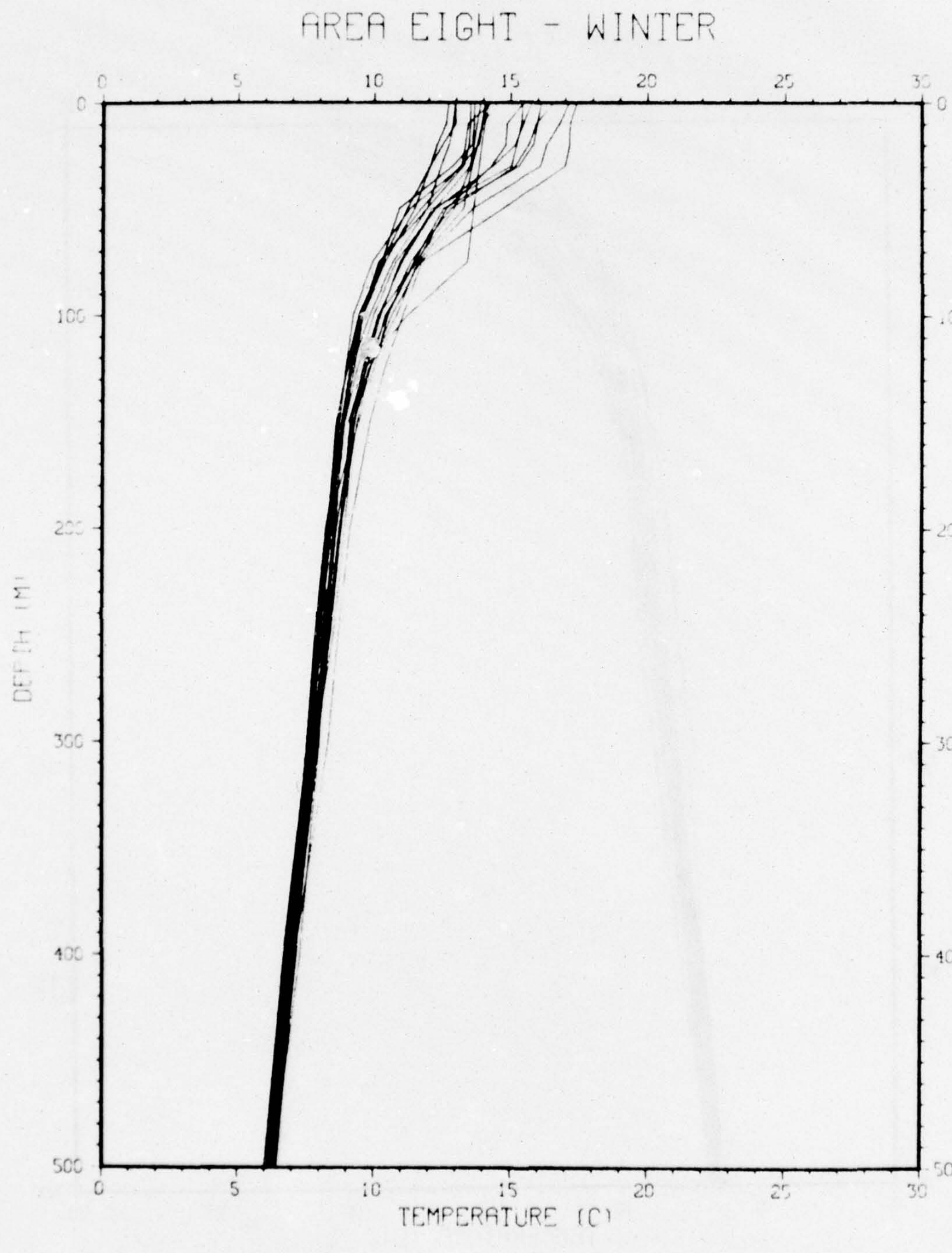
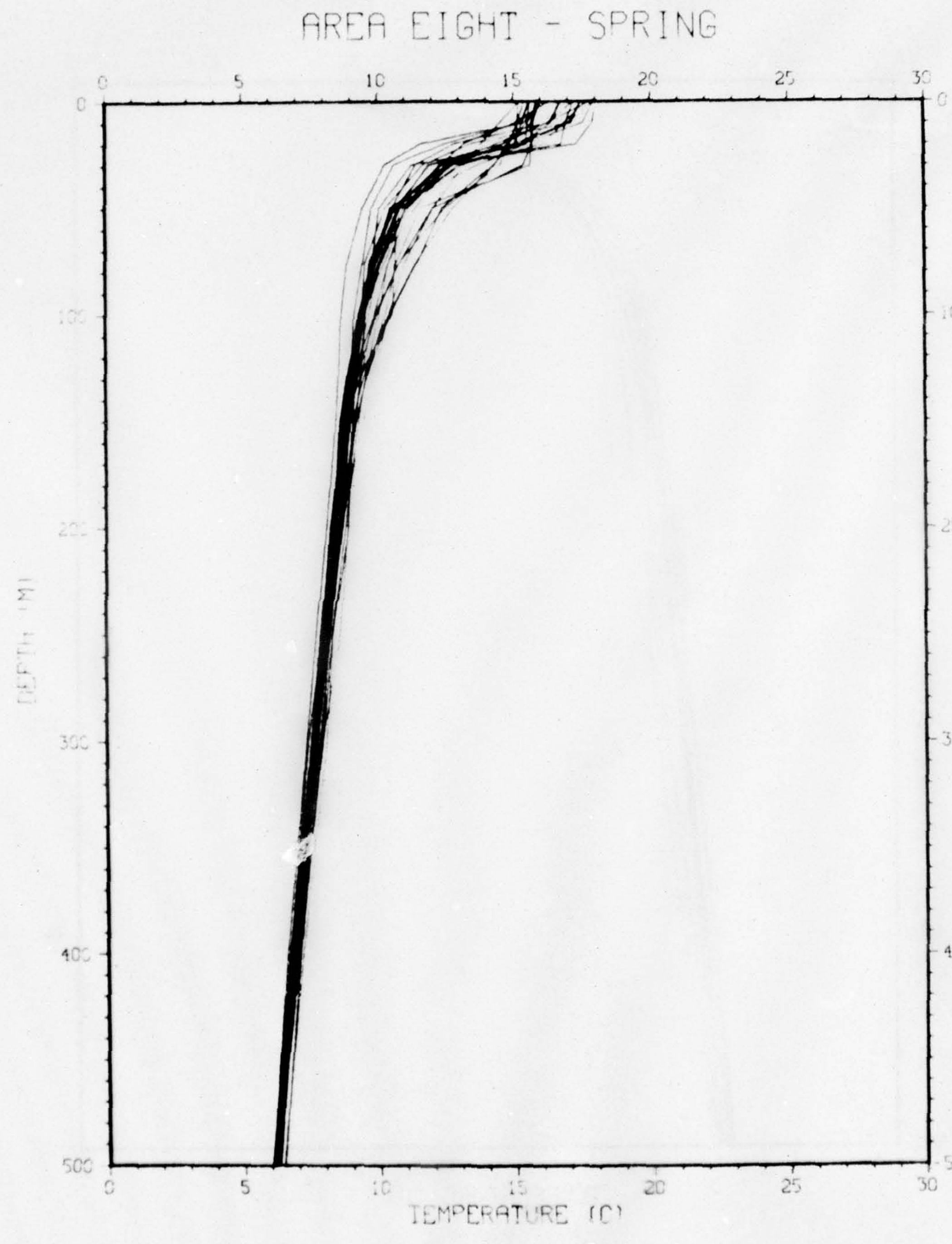

AREA EIGHT - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.30.



AREA EIGHT - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.31.

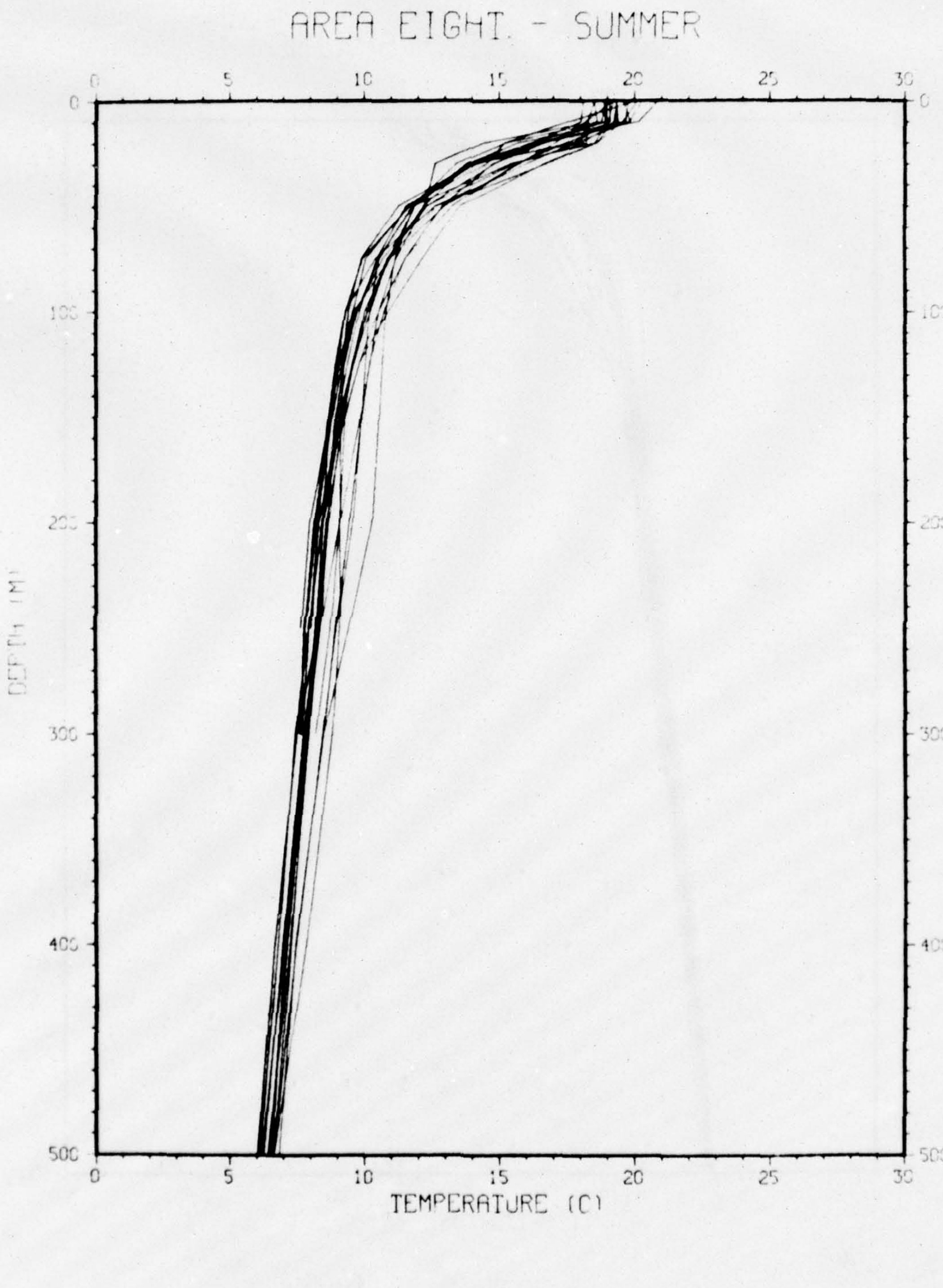
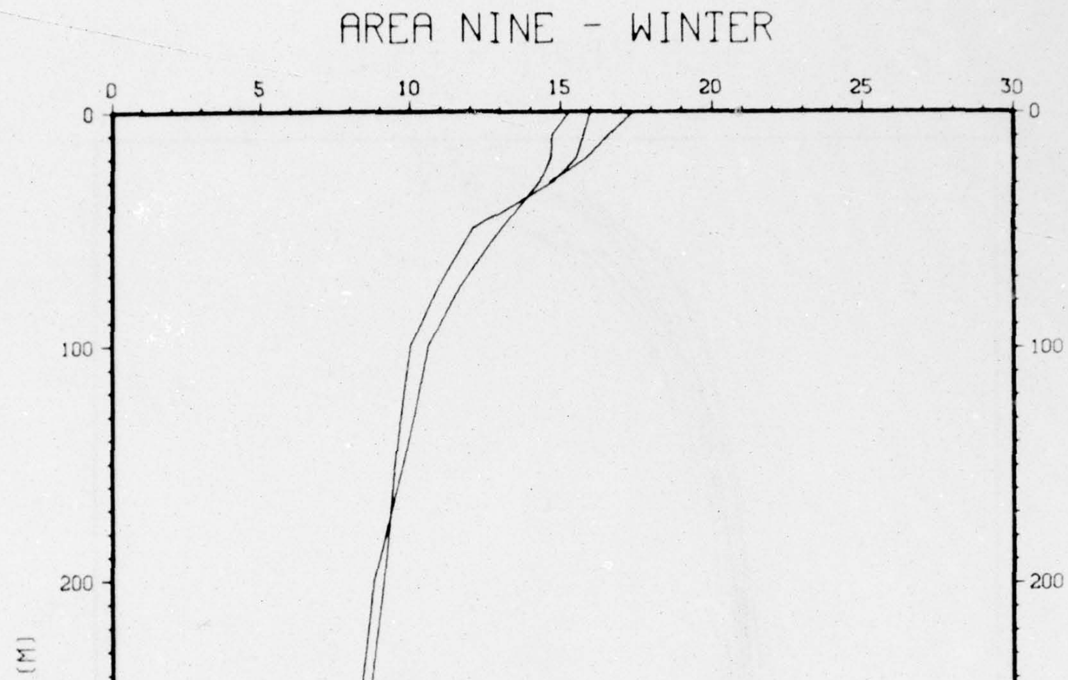

AREA EIGHT - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.32.


AREA EIGHT - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.33.



AREA NINE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.34.

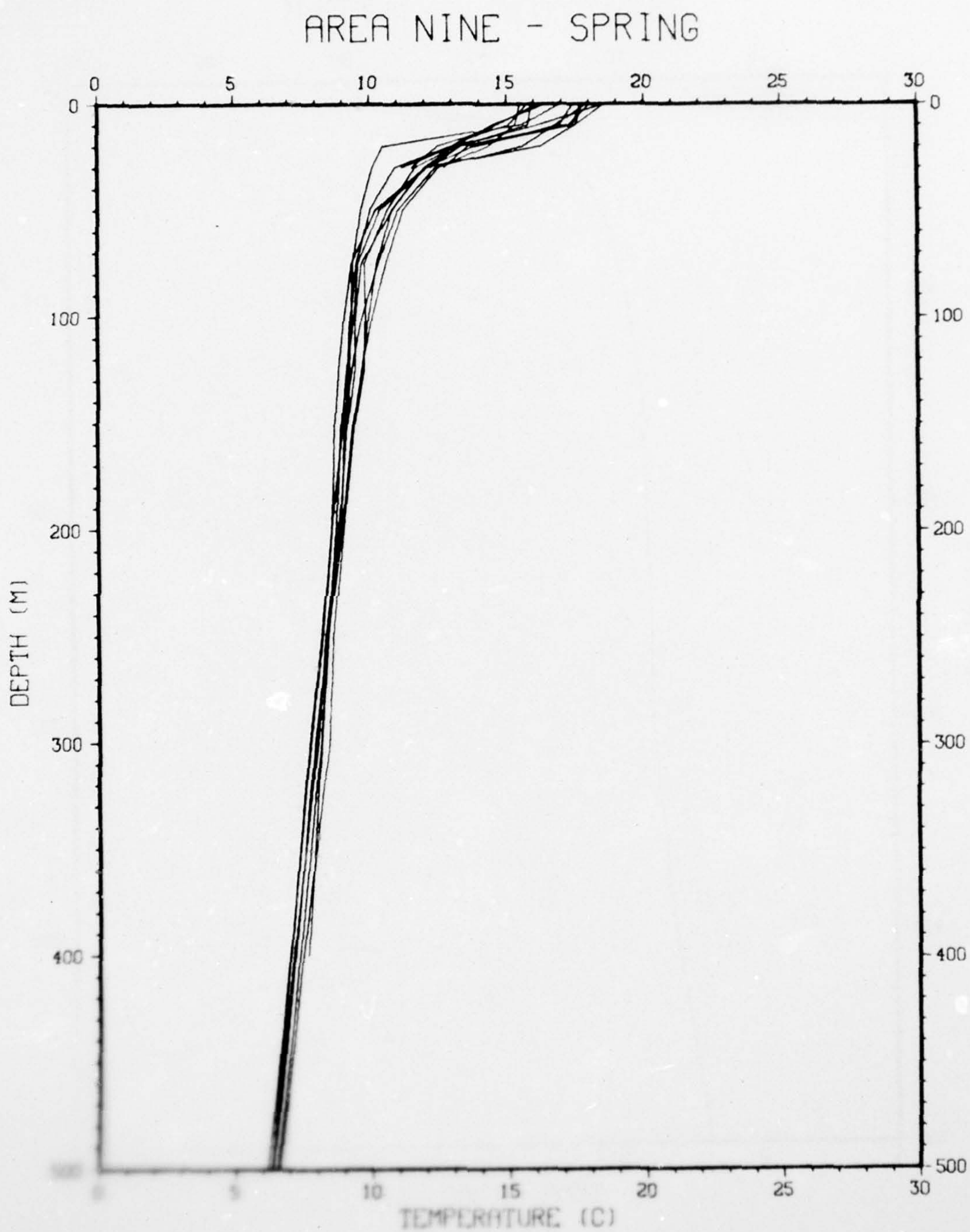
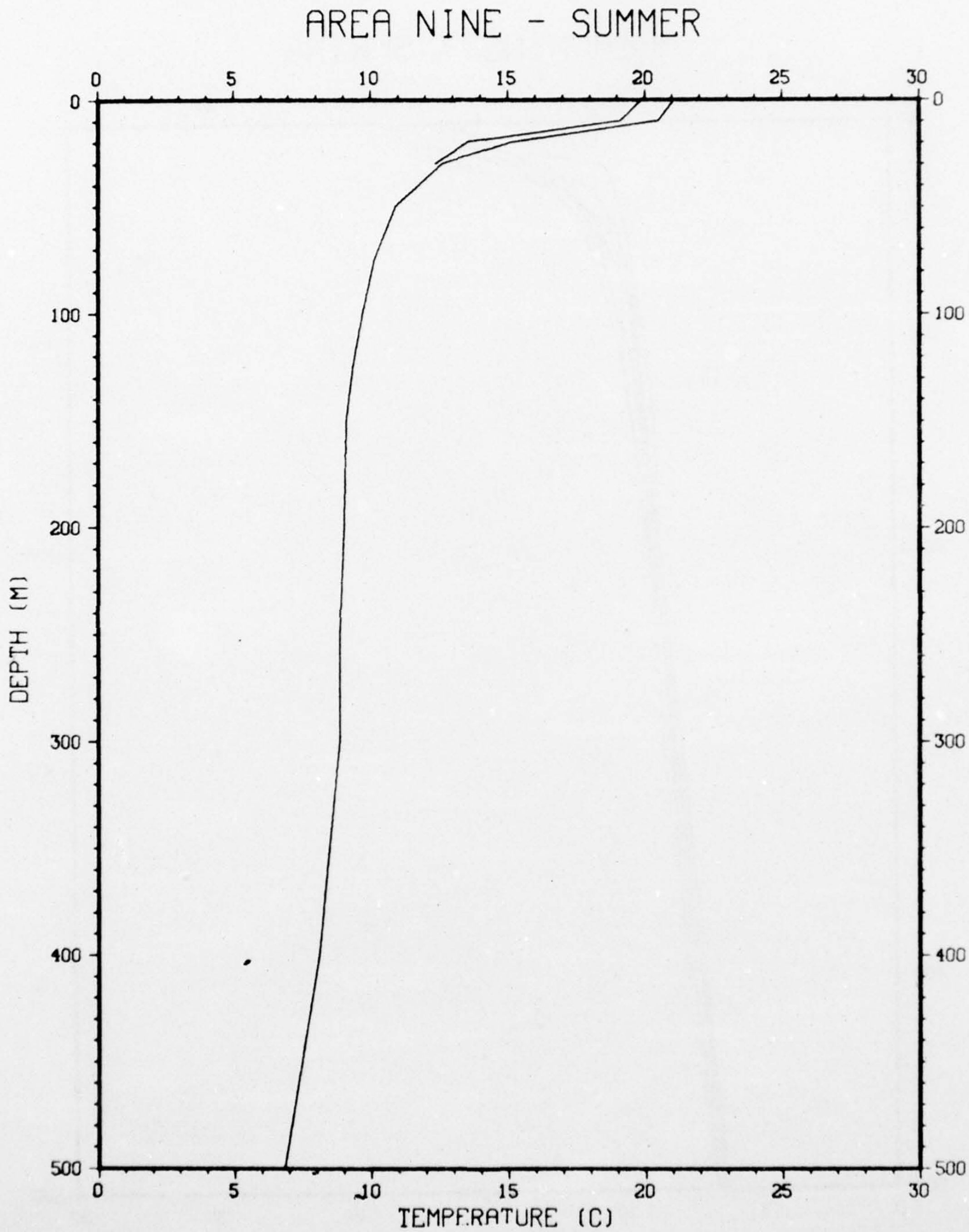
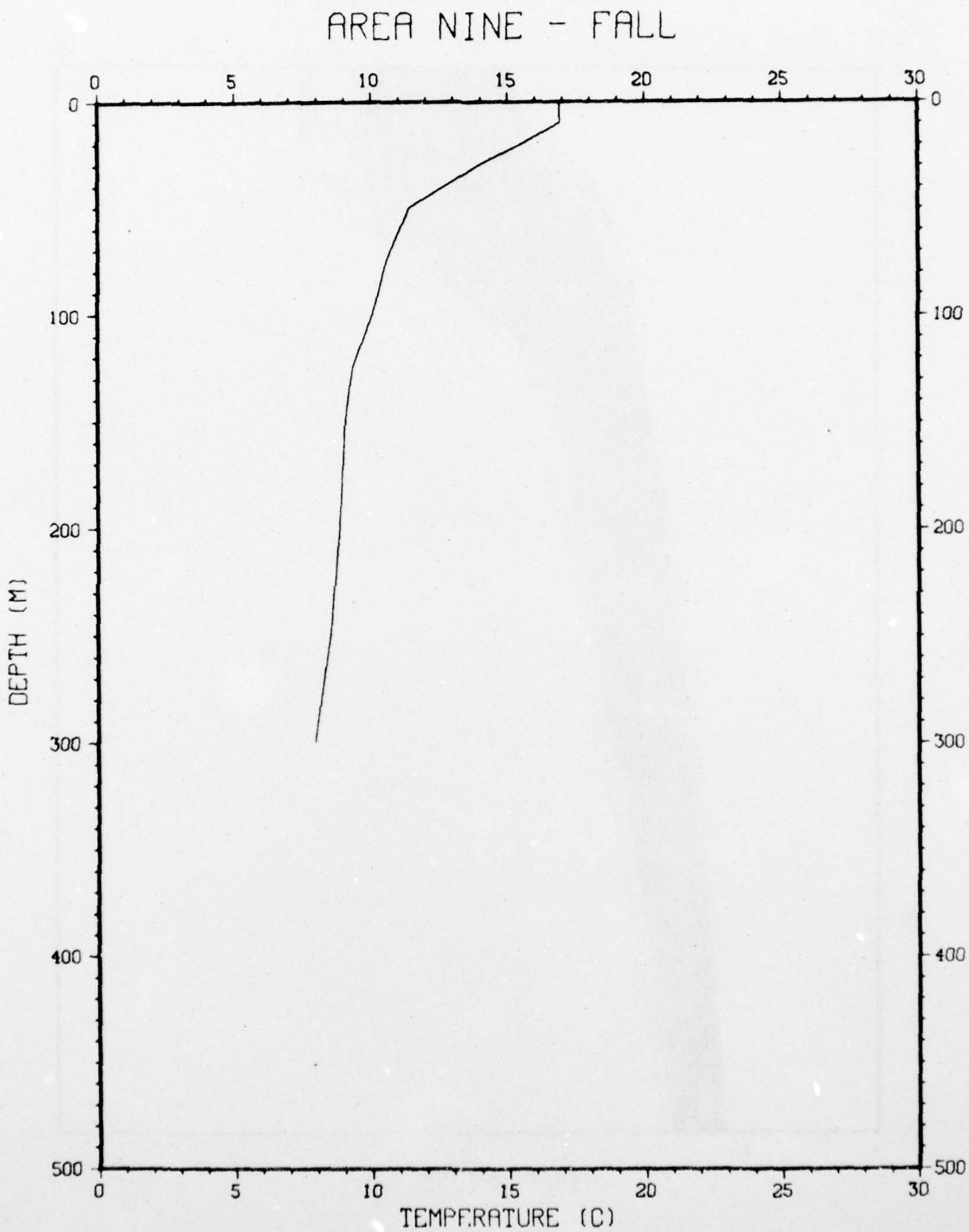

AREA NINE - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.35.



AREA NINE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.36.



AREA NINE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.37.


AREA TEN - WINTER
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
0
100
200
300
400
500

Figure B.38.

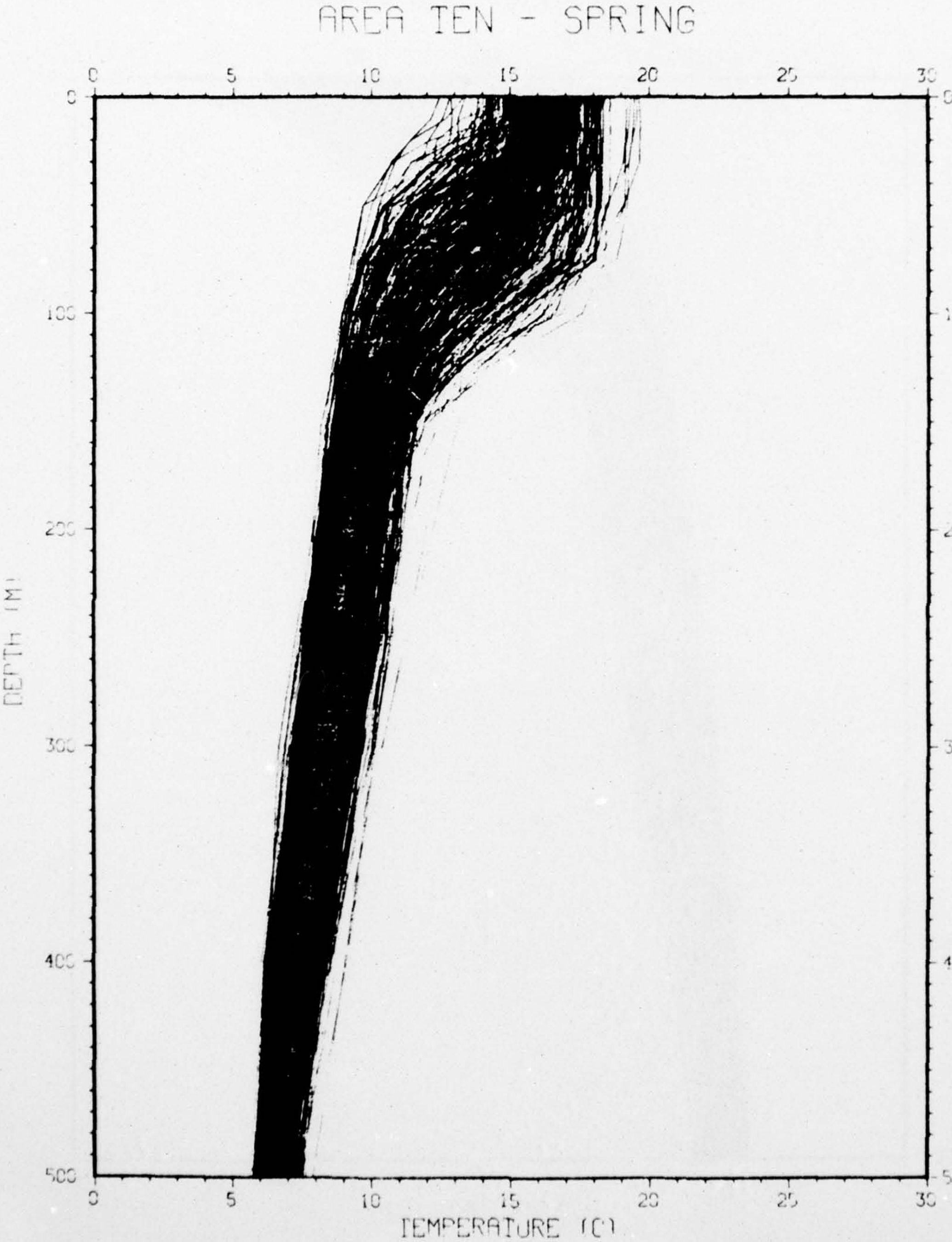

AREA TEN - SPRING
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.39.


AREA TEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.40.

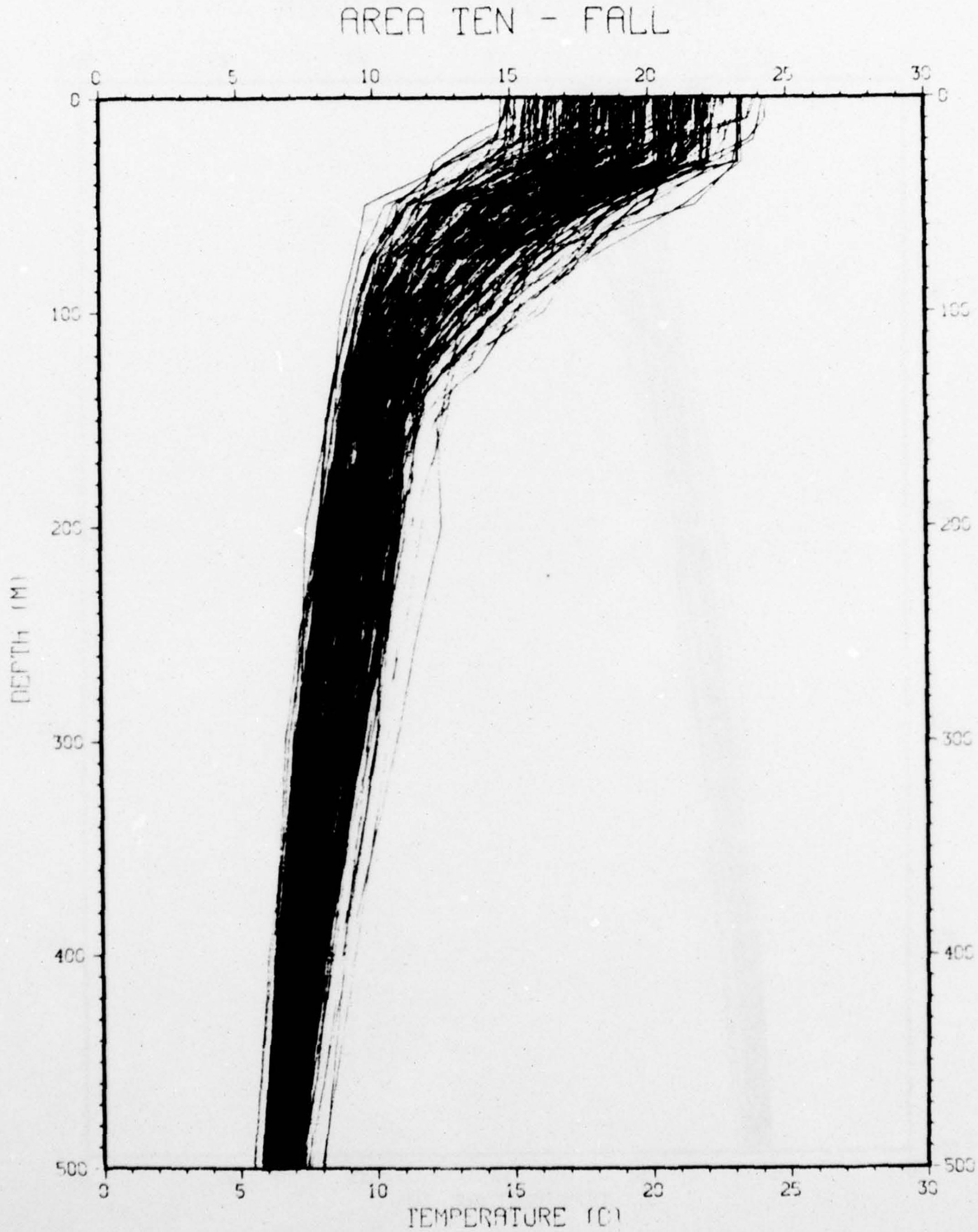
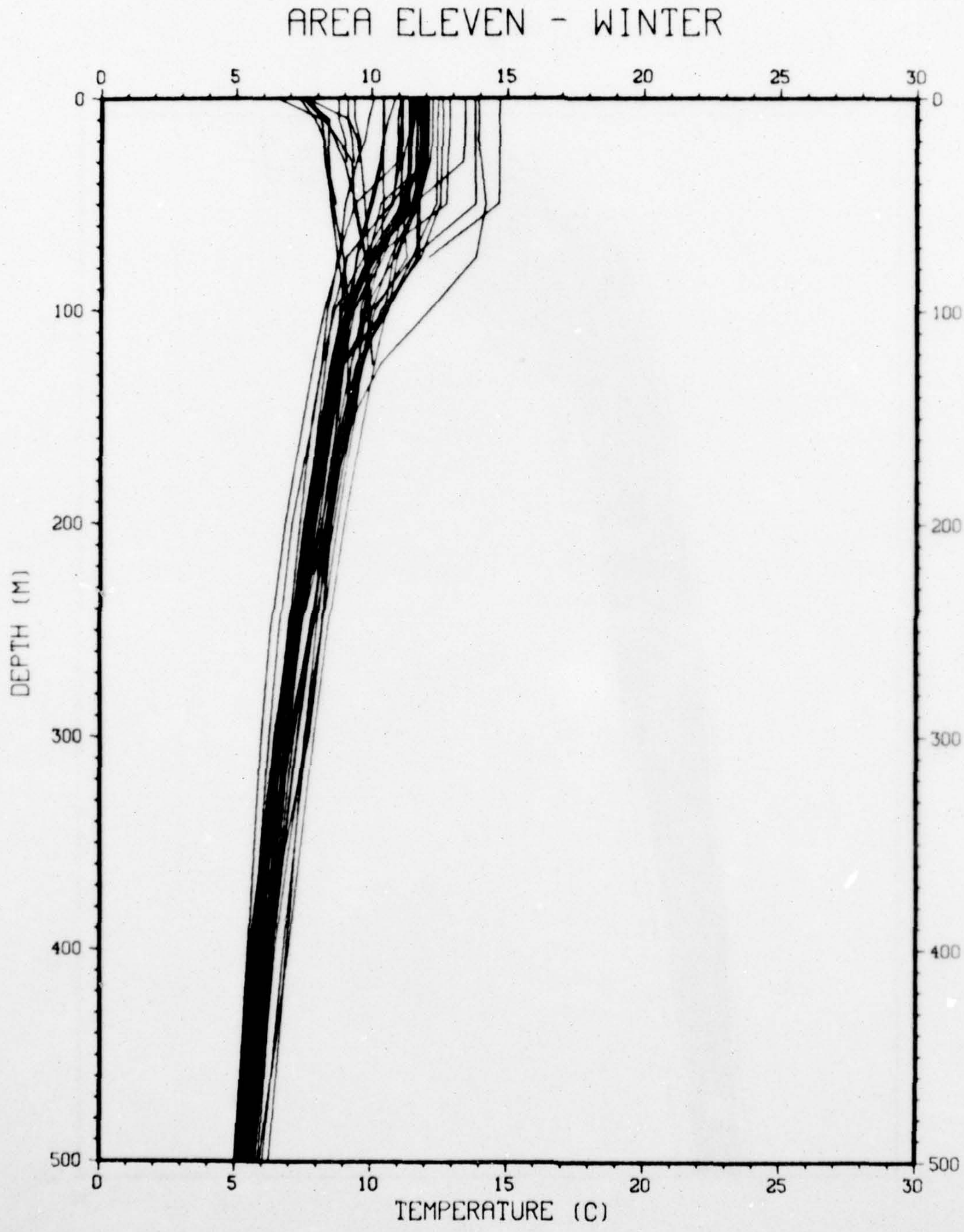

AREA TEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.41.



AREA ELEVEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.42.

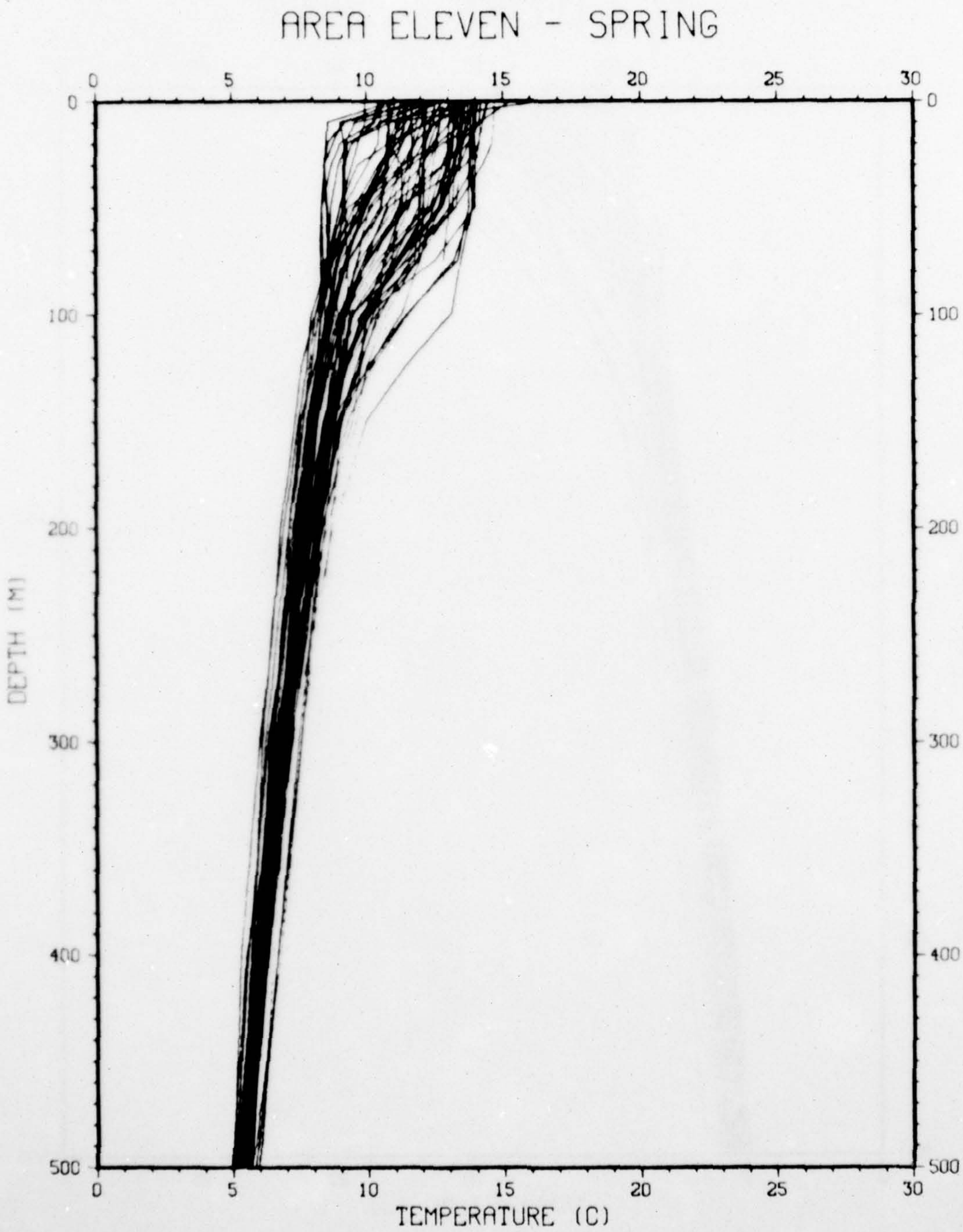

AREA ELEVEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.43.

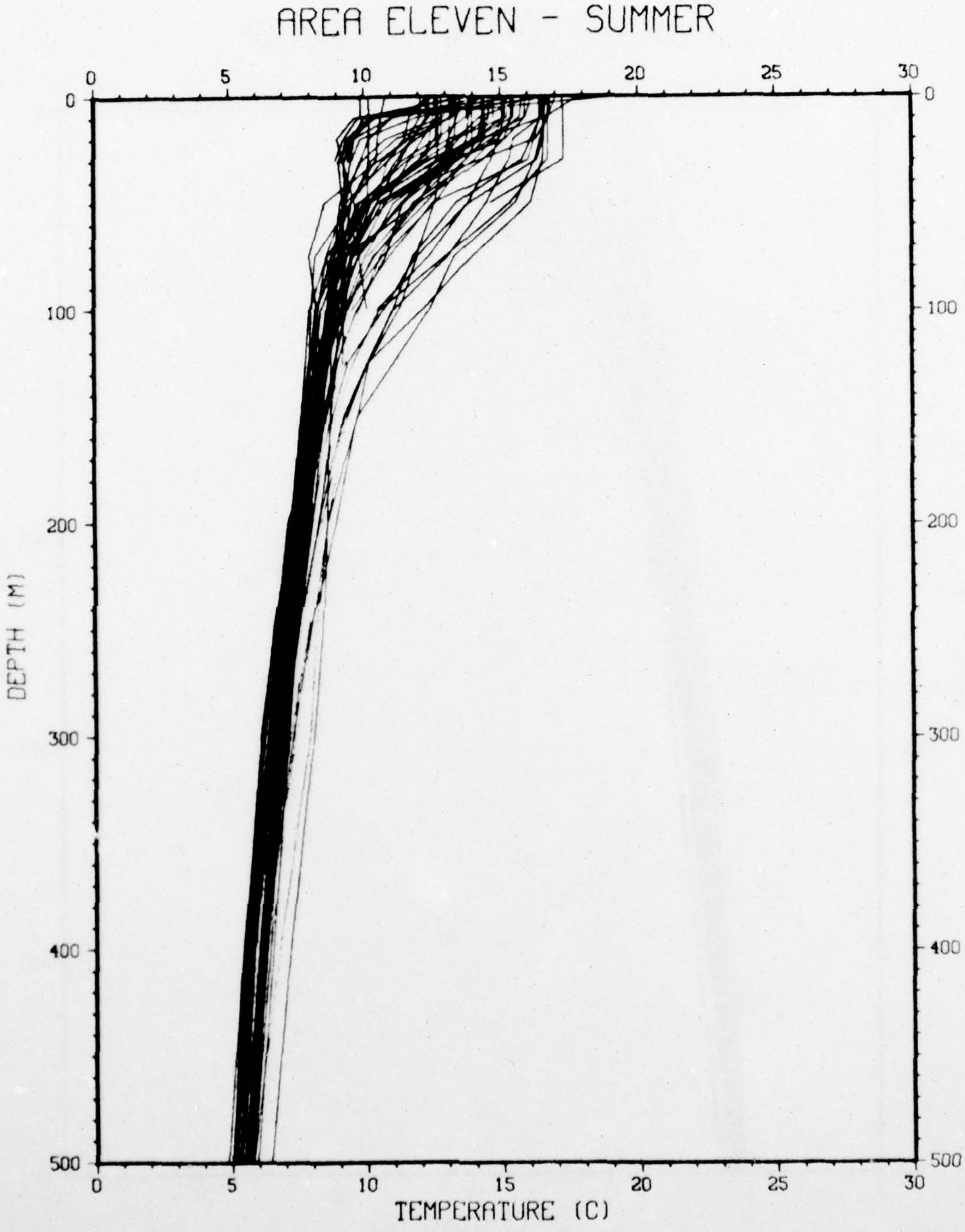

AREA ELEVEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.44.

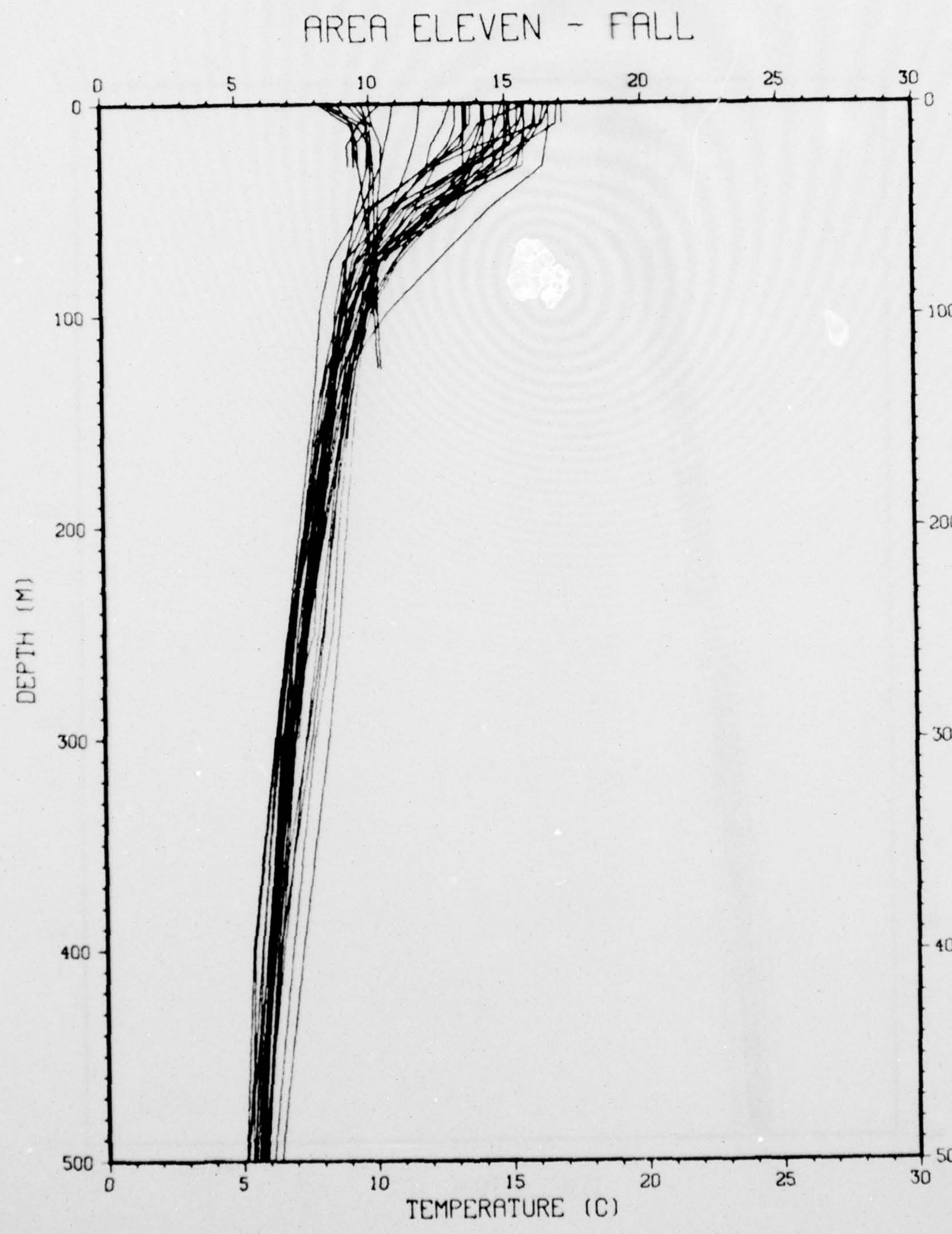
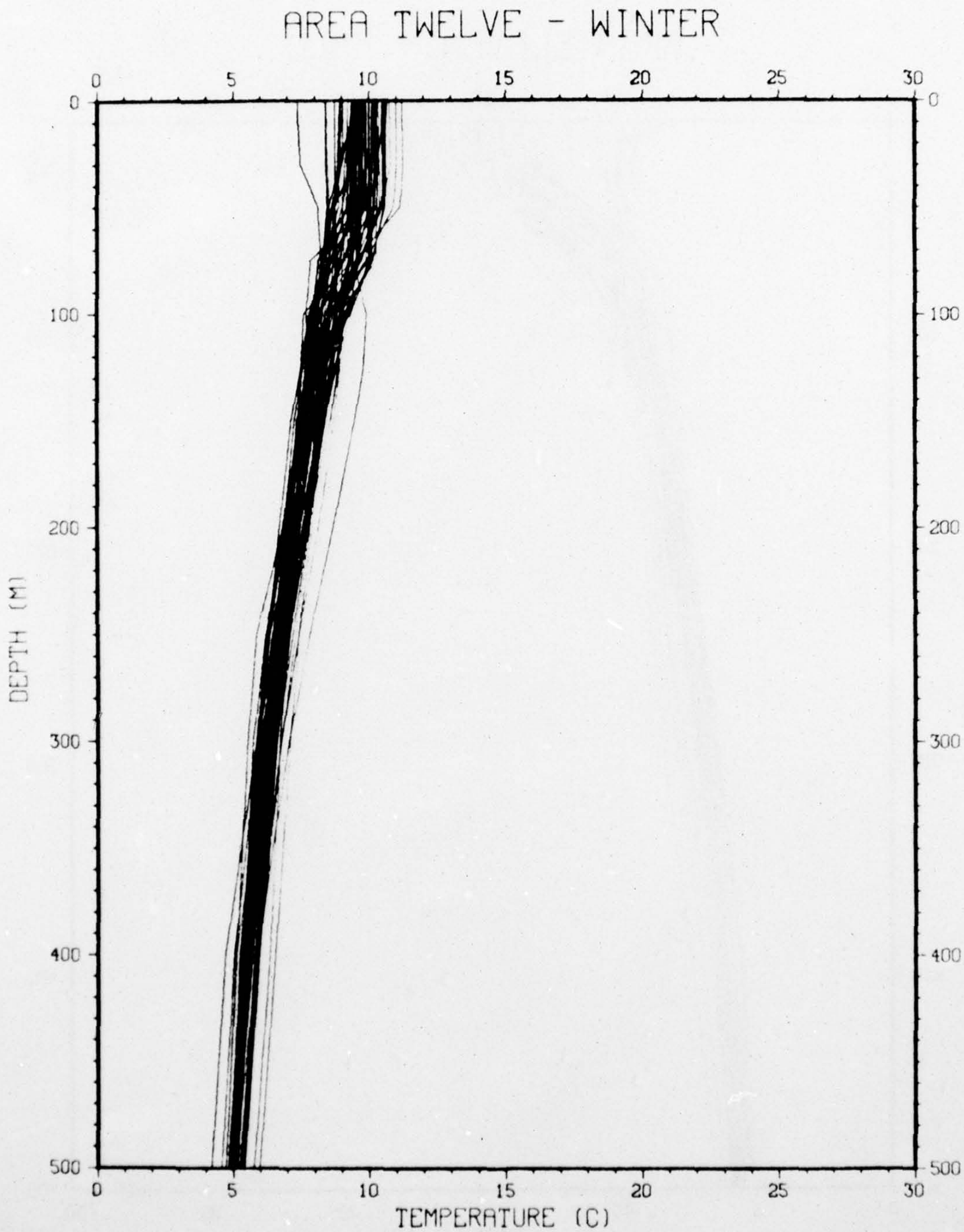

AREA ELEVEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.45.



AREA TWELVE - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.46.

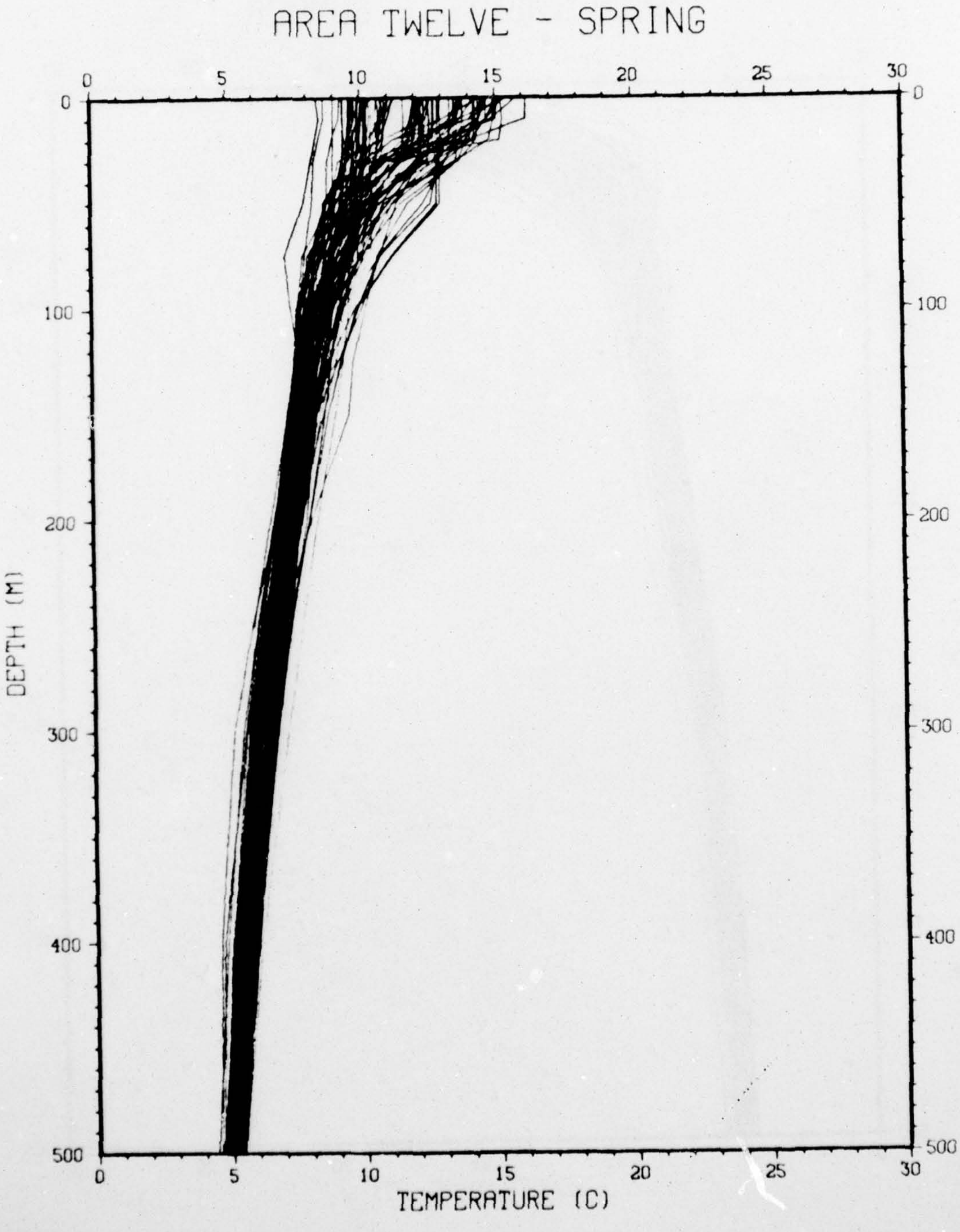

AREA TWELVE - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.47.

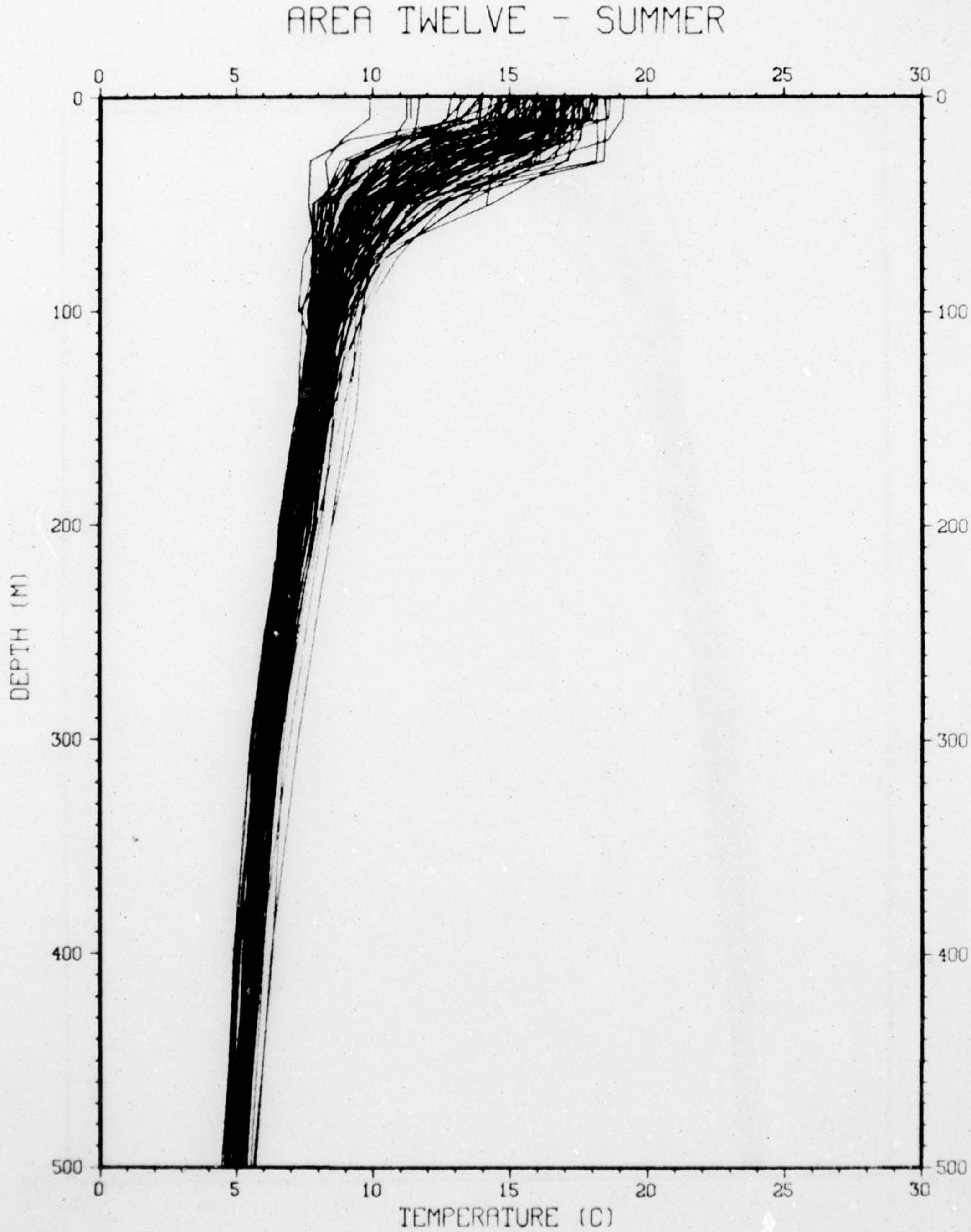

AREA TWELVE - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.48.

AD-A044 530 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CALIF F/G 8/1
SURVEY OF OCEANOGRAPHIC AND METEOROLOGICAL PARAMETERS OF IMPORT--ETC(U)
AUG 77 P F SELIGMAN E(49-26)-1027
UNCLASSIFIED NOSC/TR-121 NL

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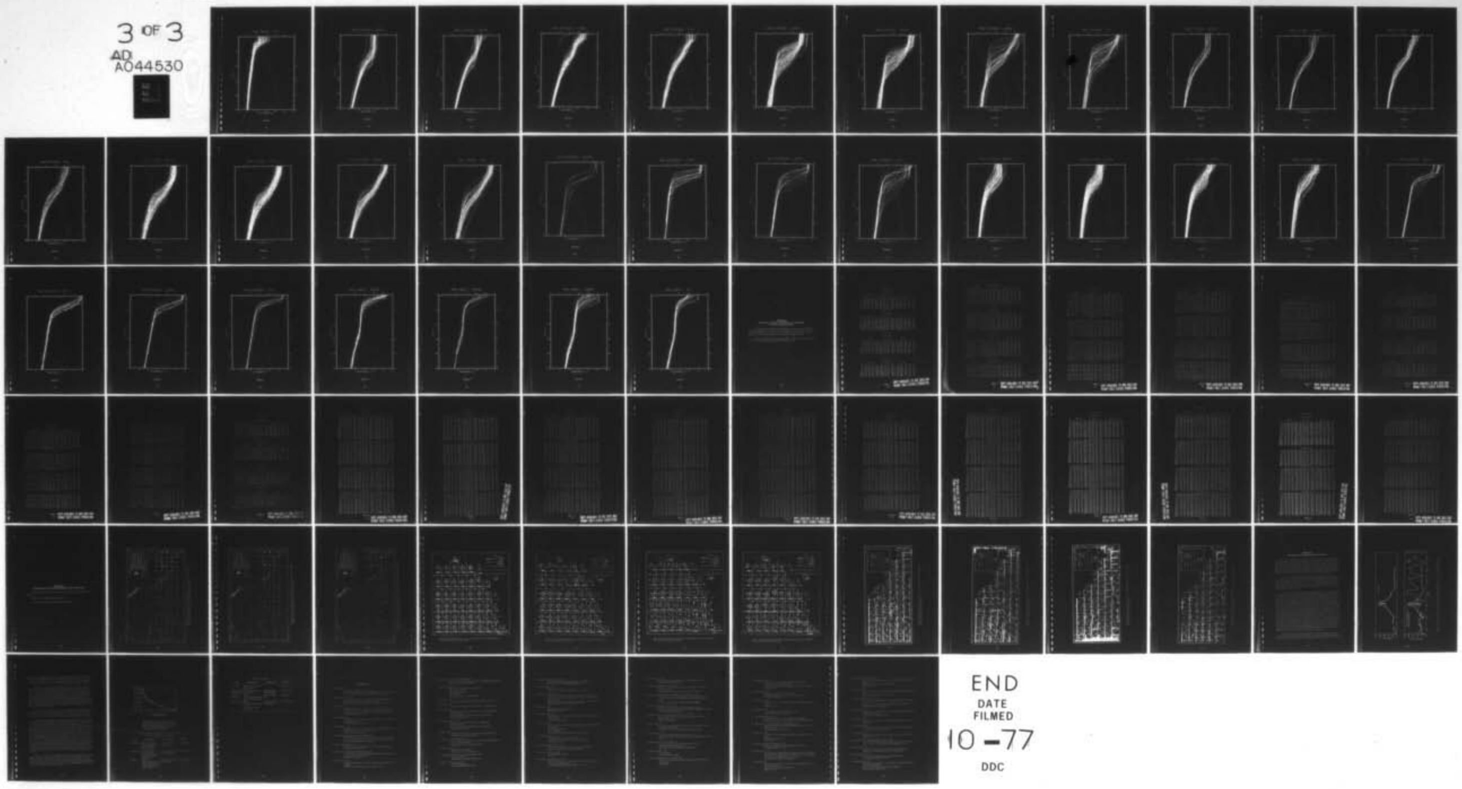

END
DATE
FILMED
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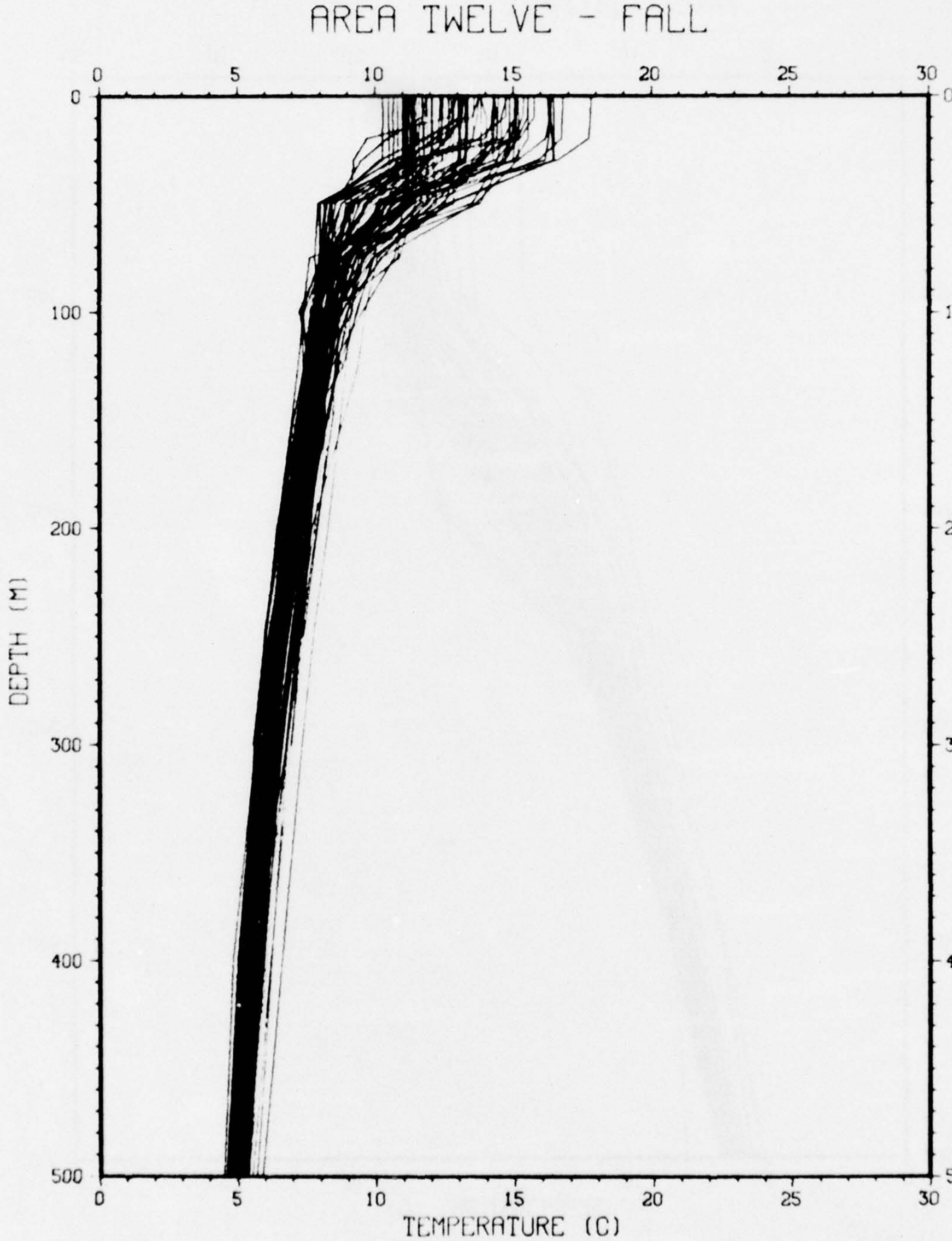
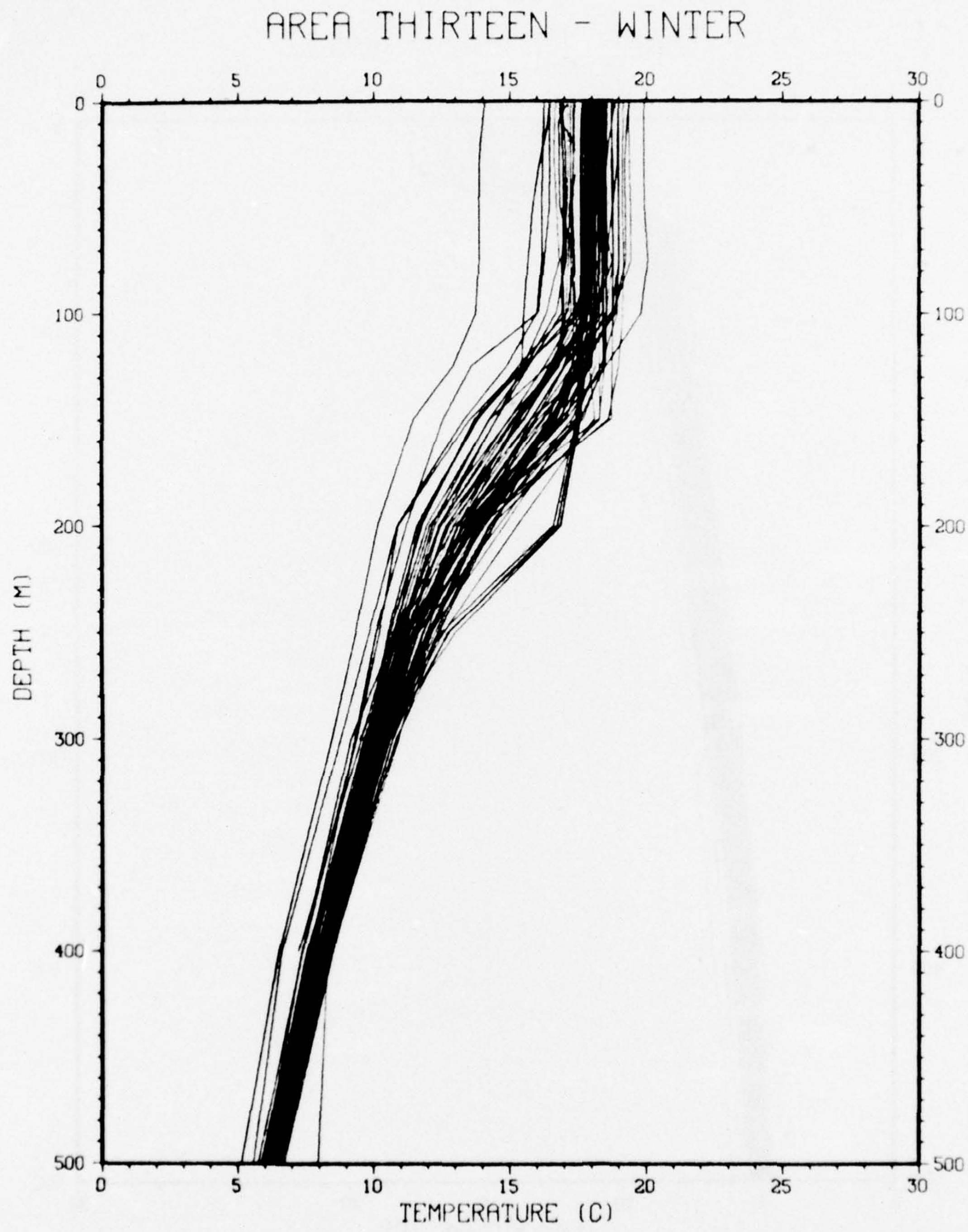


AREA TWELVE - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.49.



AREA THIRTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.50.

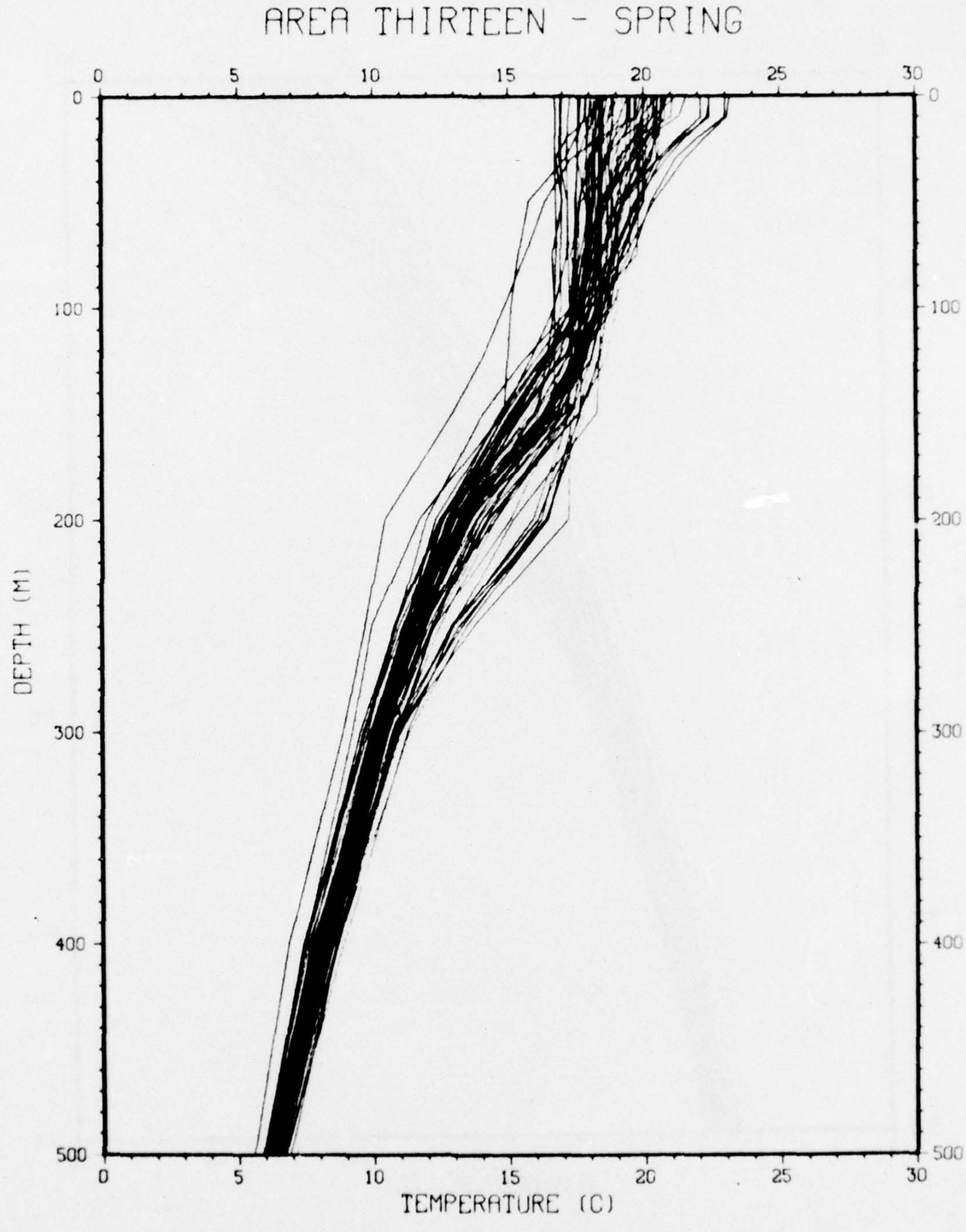

AREA THIRTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.51.

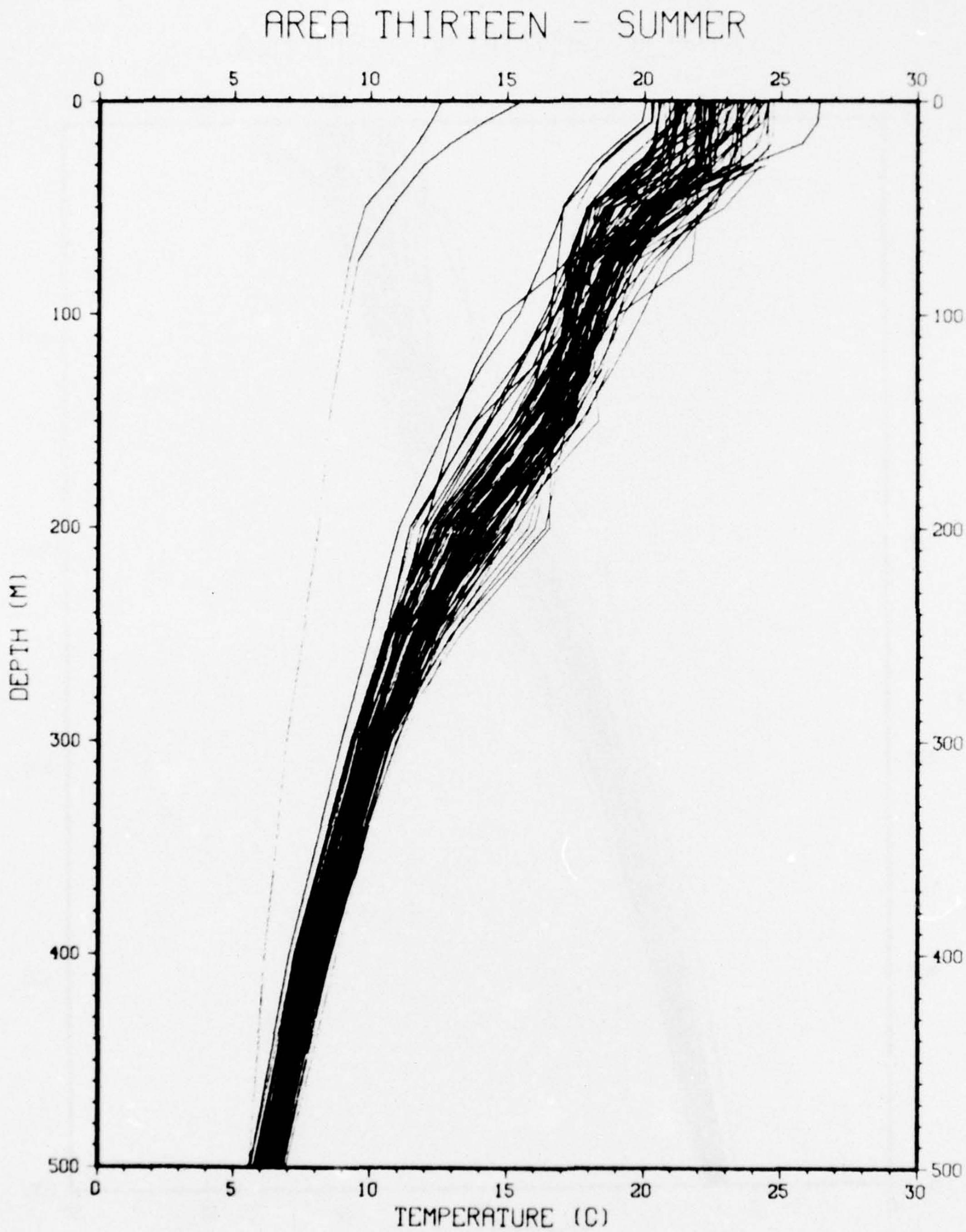
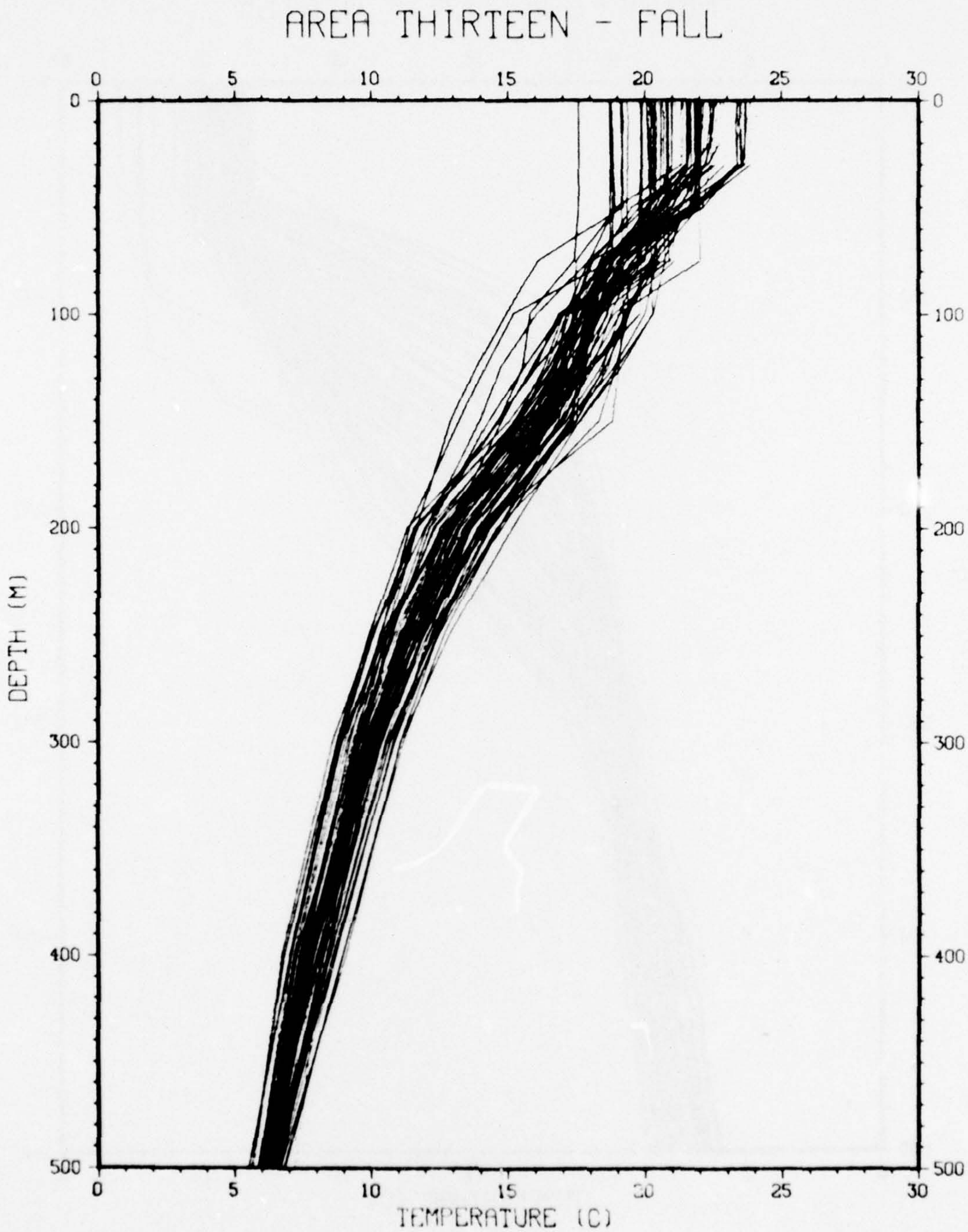

AREA THIRTEEN - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.52.



AREA THIRTEEN - FALL
0 5 10 15 20 25 30
DEPTH (M)
0
100
200
300
400
500
TEMPERATURE (C)

Figure B.53.

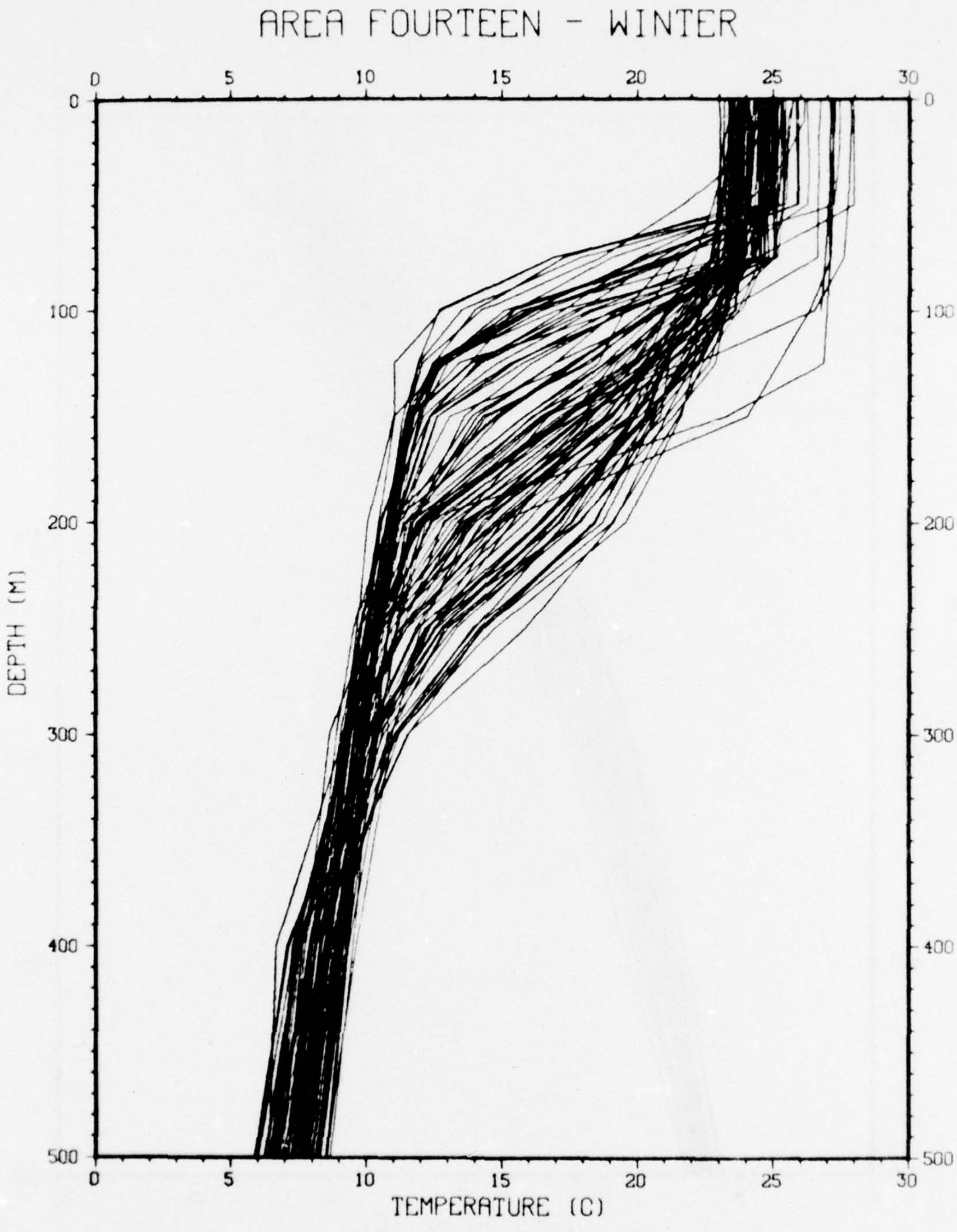

AREA FOURTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.54.

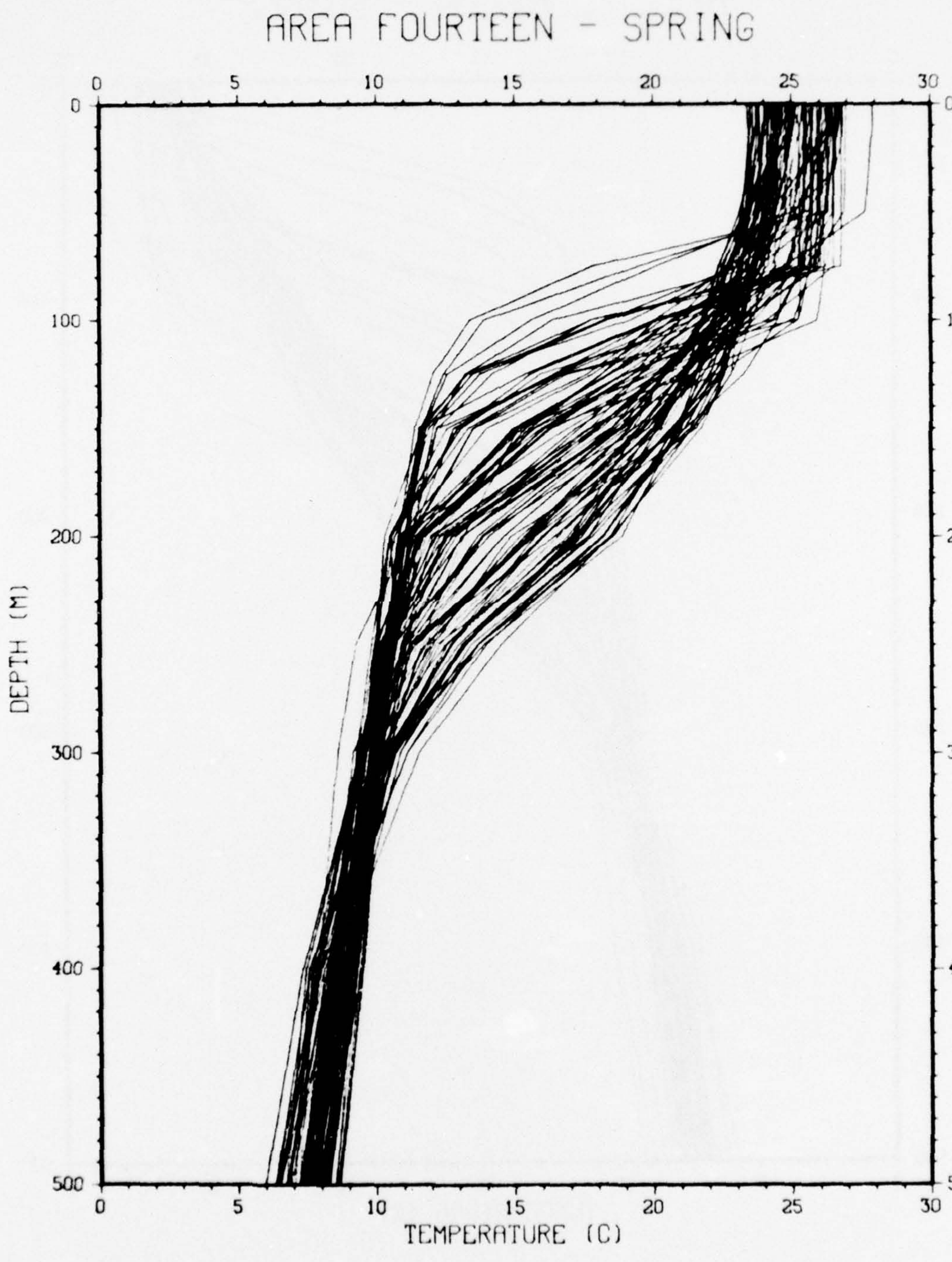

AREA FOURTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.55.

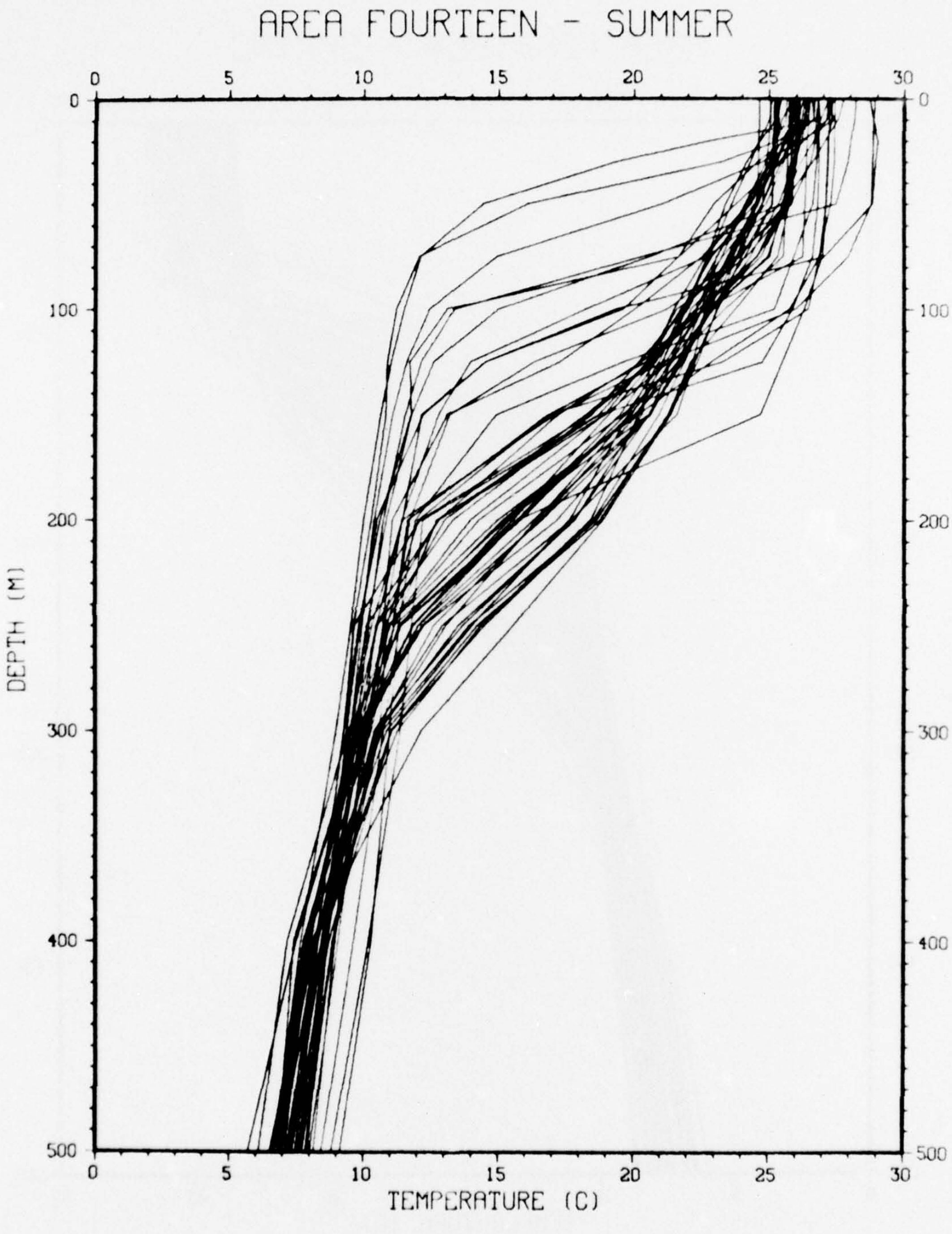
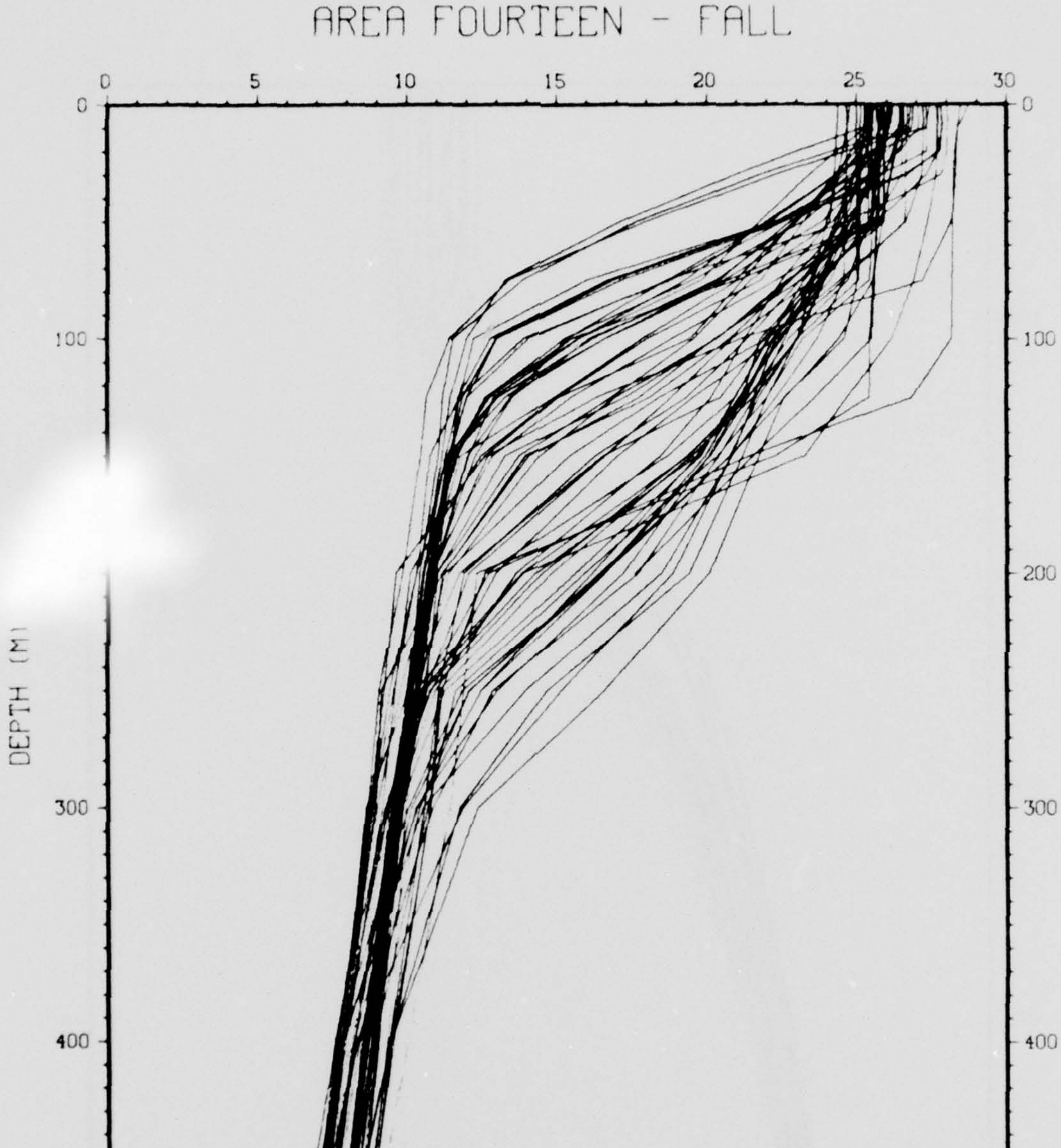

AREA FOURTEEN - SUMMER
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.56.

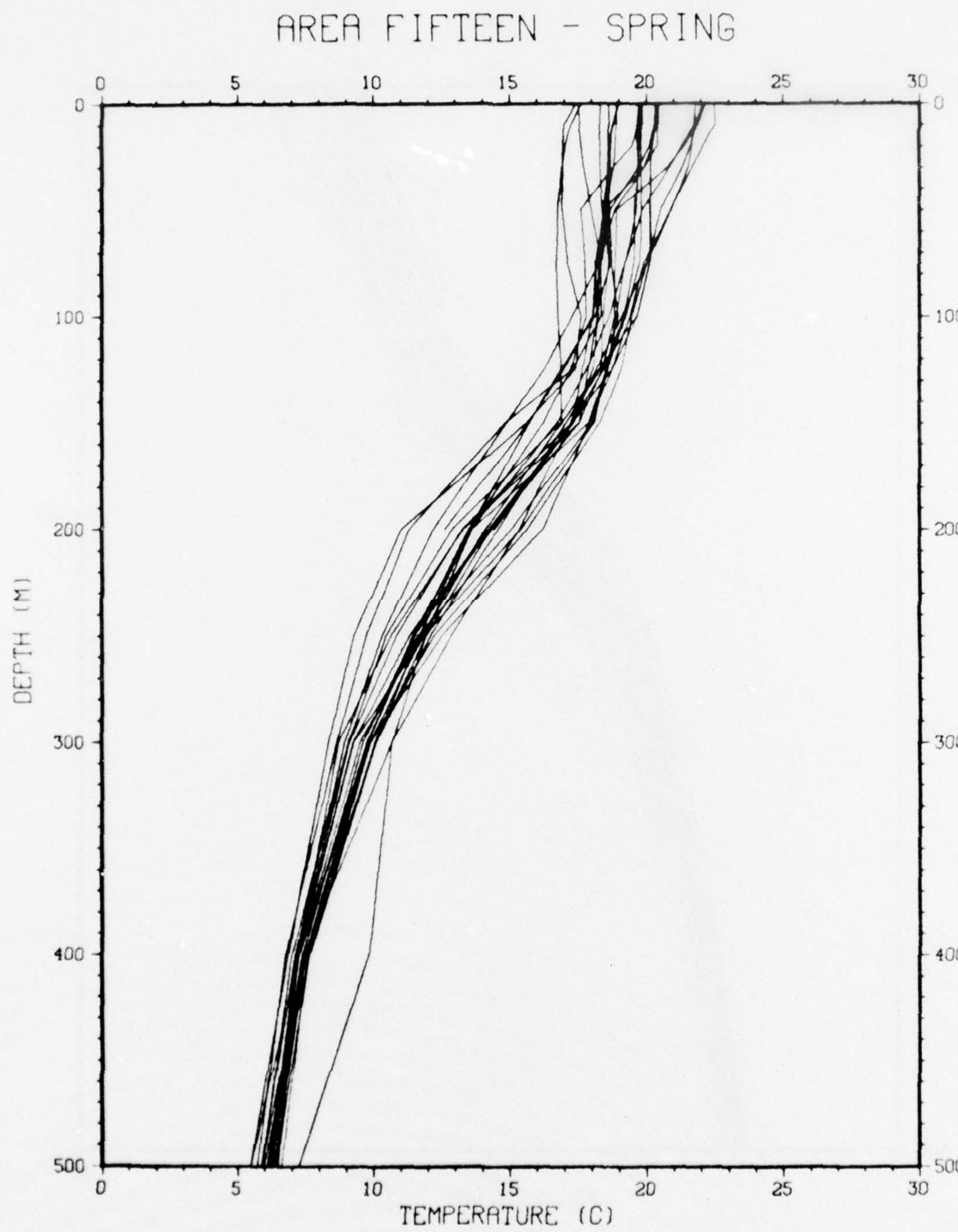


AREA FOURTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.57.

AREA FIFTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.58.



AREA FIFTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.59.

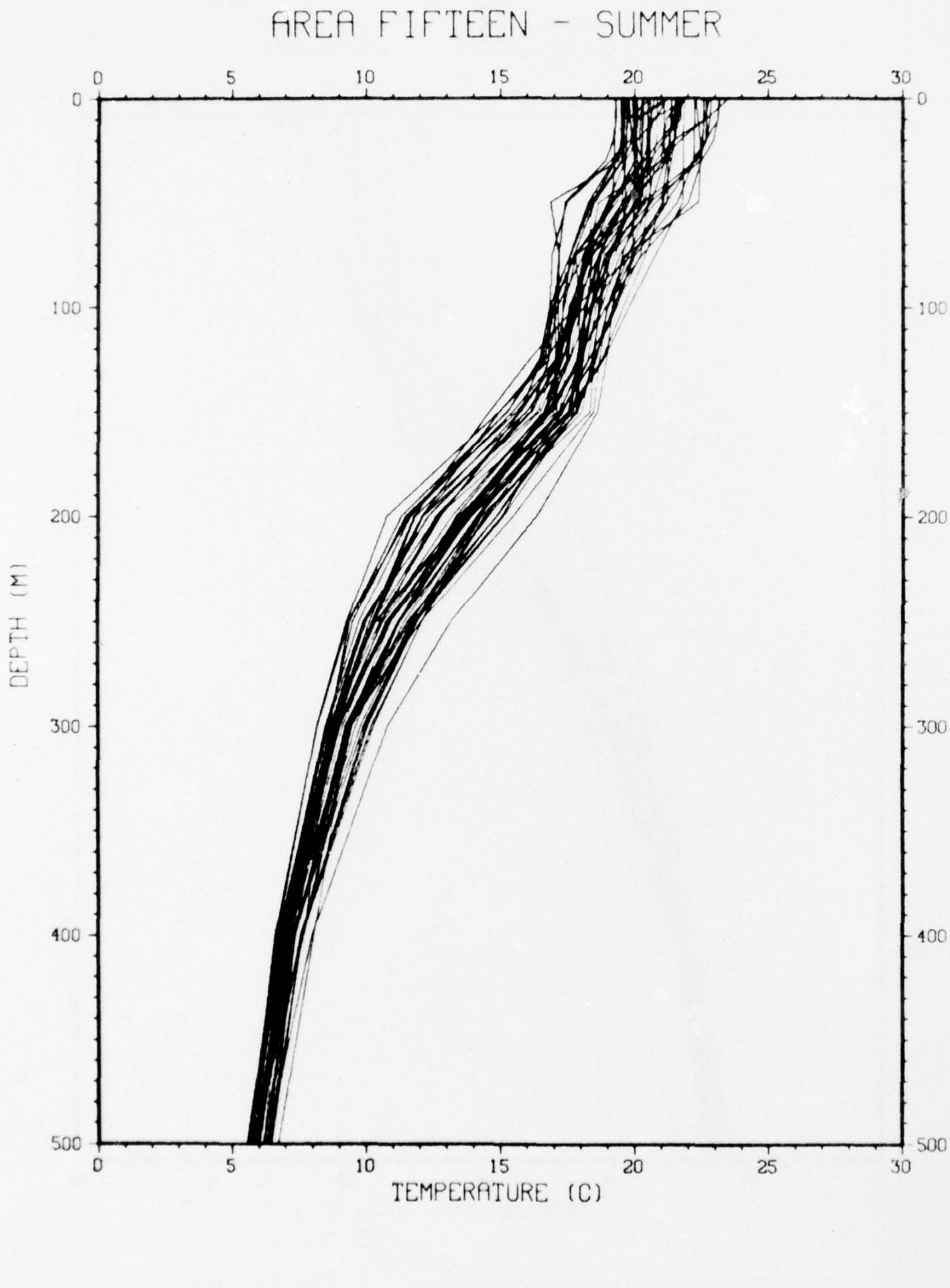
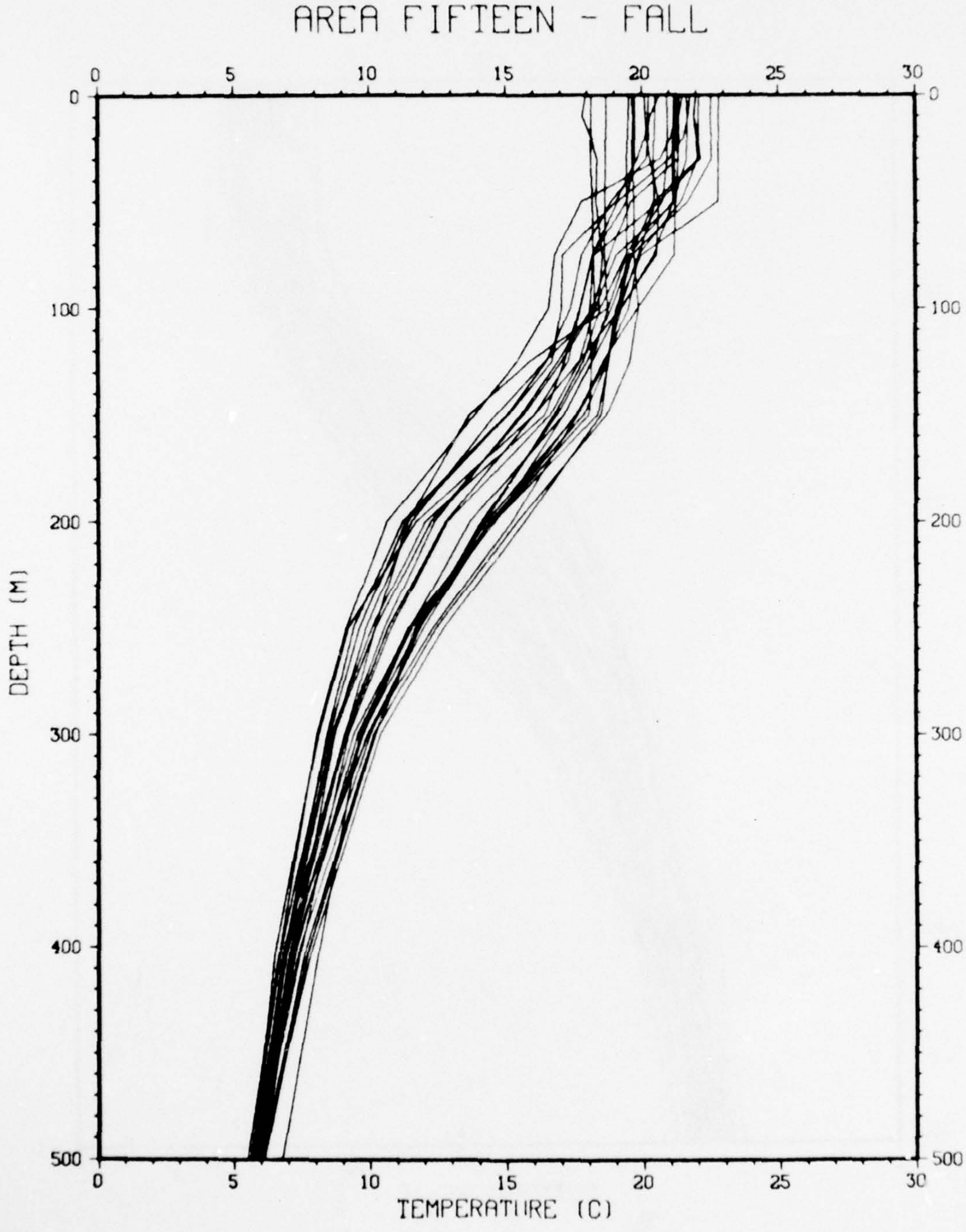

AREA FIFTEEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.60.



AREA FIFTEEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.61.

AREA SIXTEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

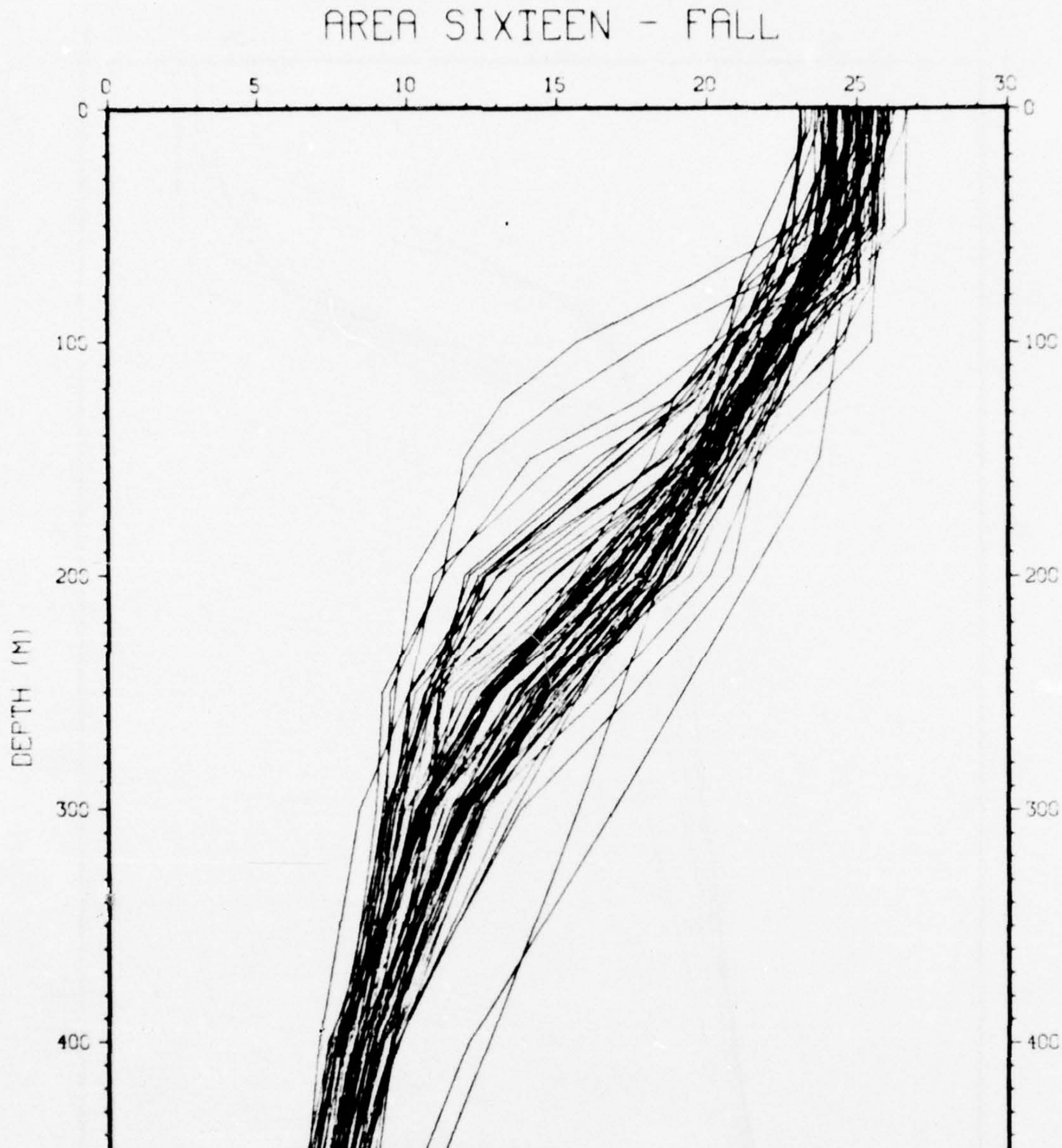
Figure B.62.


AREA SIXTEEN - SPRING
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.63.


AREA SIXTEEN - SUMMER
0
5
10
15
20
25
30
DEPTH (M)
100
200
300
400
500
TEMPERATURE (C)

Figure B.64.



AREA SIXTEEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.65.

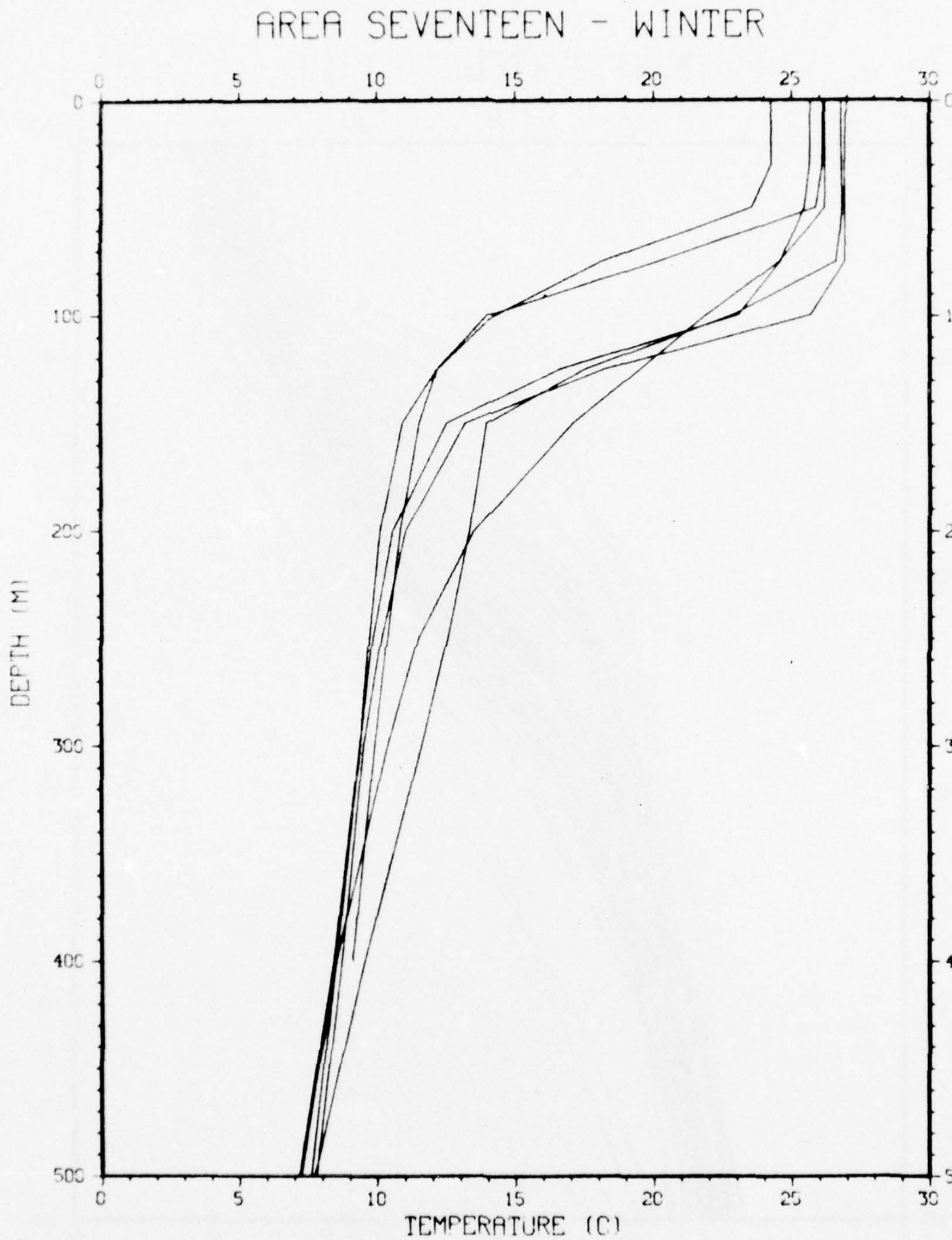

AREA SEVENTEEN - WINTER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.66.

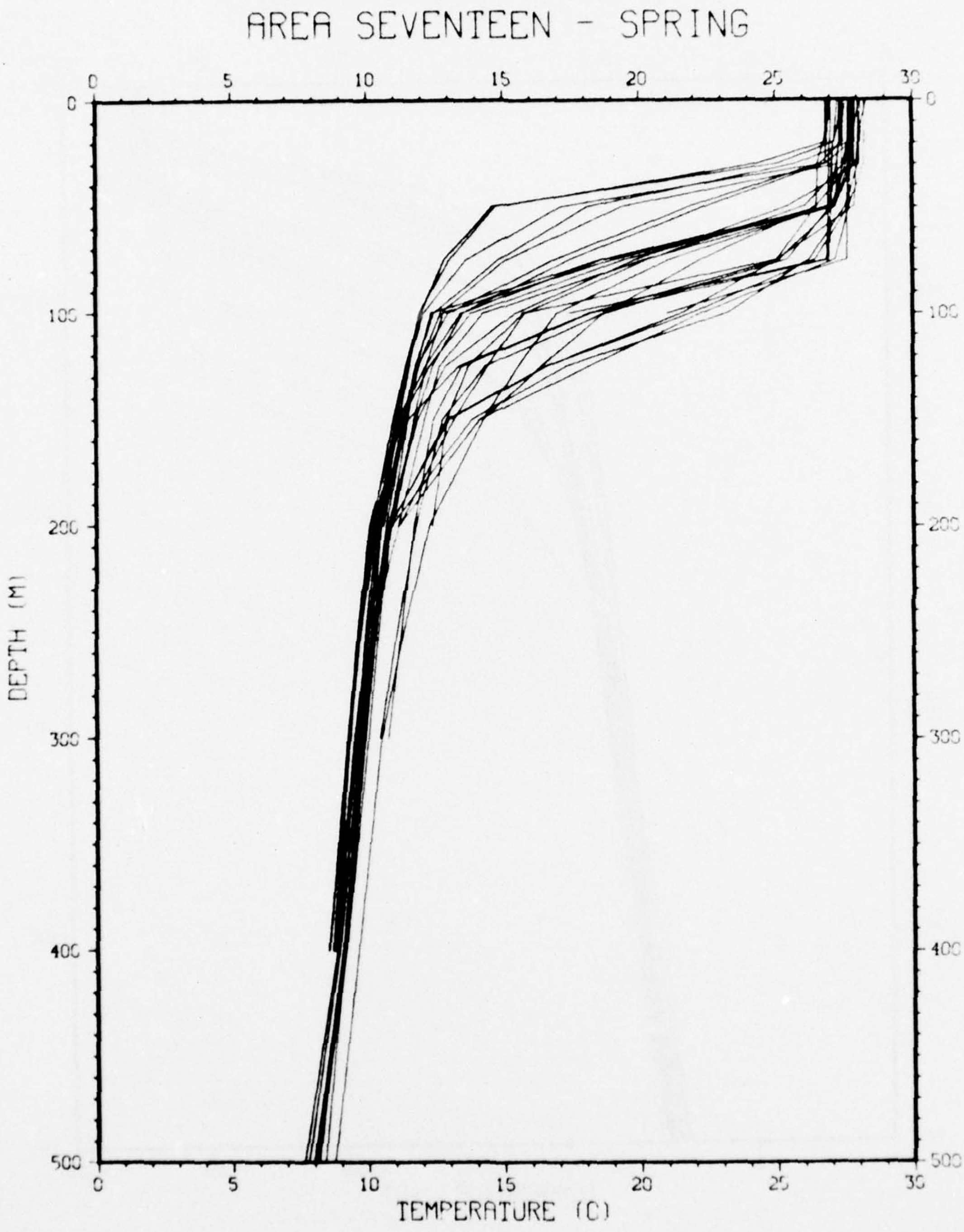
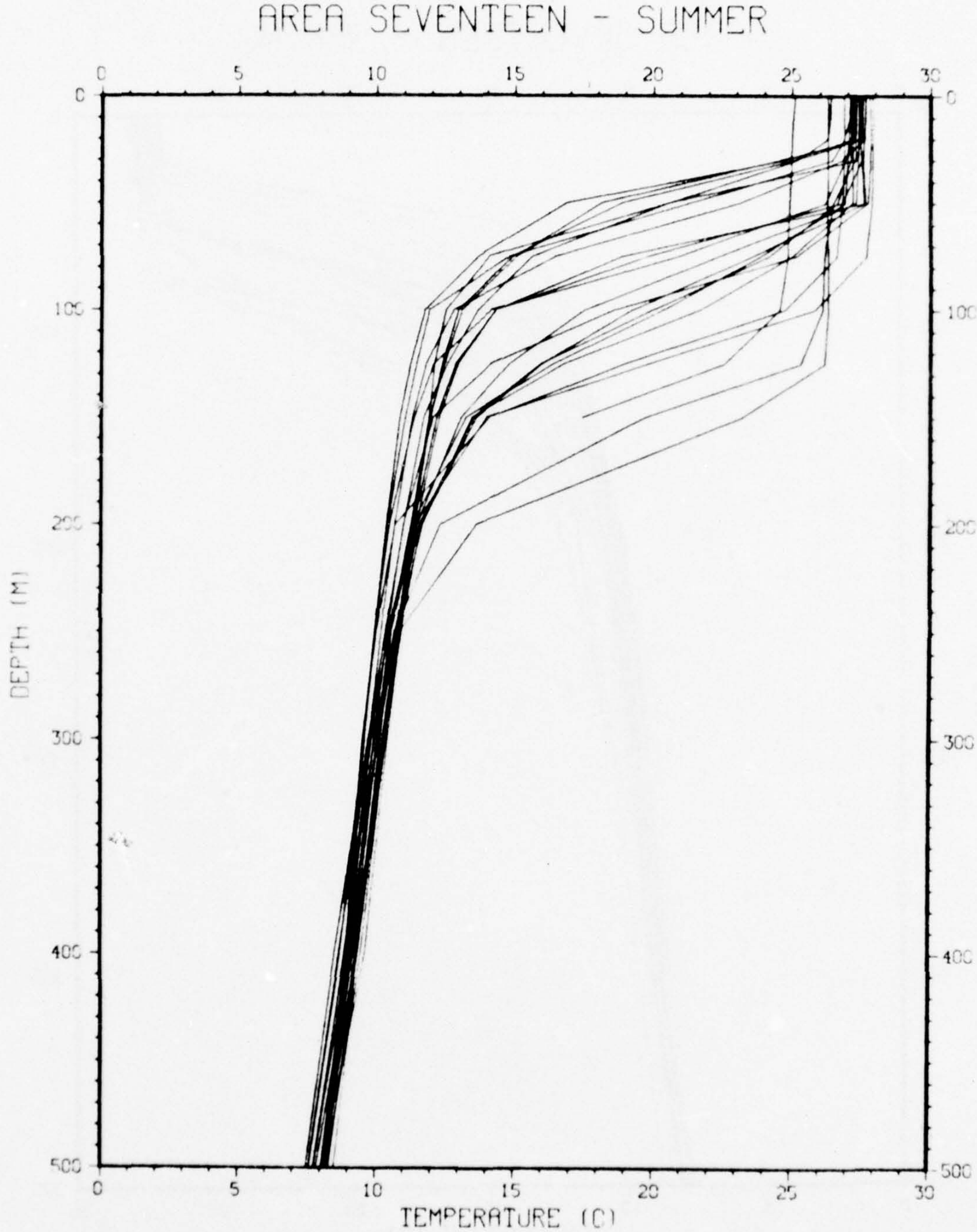

AREA SEVENTEEN - SPRING
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.67.



AREA SEVENTEEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.68.

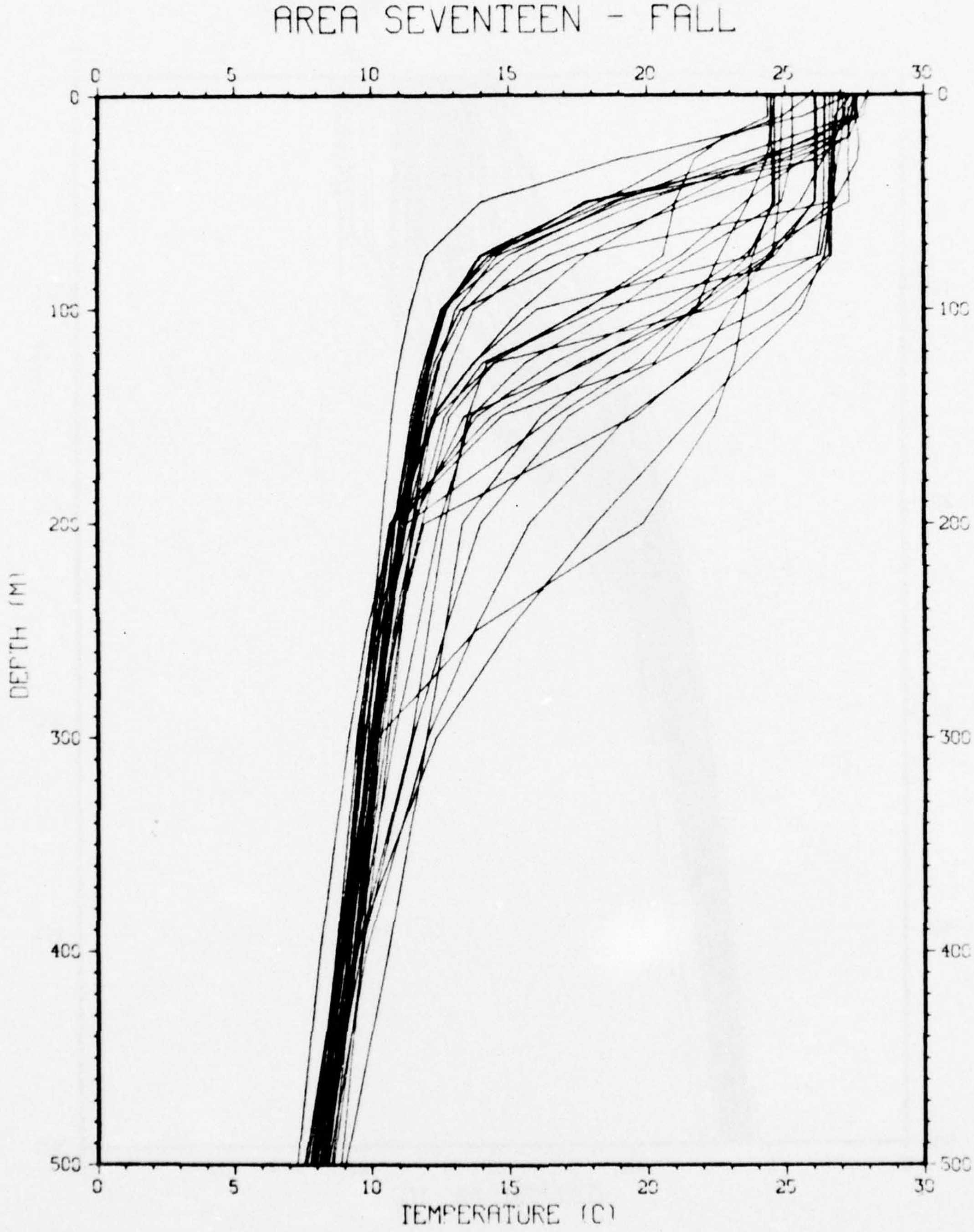

AREA SEVENTEEN - FALL
DEPTH (M)
TEMPERATURE (C)
0
5
10
15
20
25
30
100
200
300
400
500

Figure B.69.

AREA EIGHTEEN - WINTER
0
5
10
15
20
25
30
DEPTH (M)
0
100
200
300
400
500
TEMPERATURE (C)

Figure B.70.


AREA EIGHTEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.71.

AREA EIGHTEEN - SUMMER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.72.


AREA EIGHTEEN - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.73.

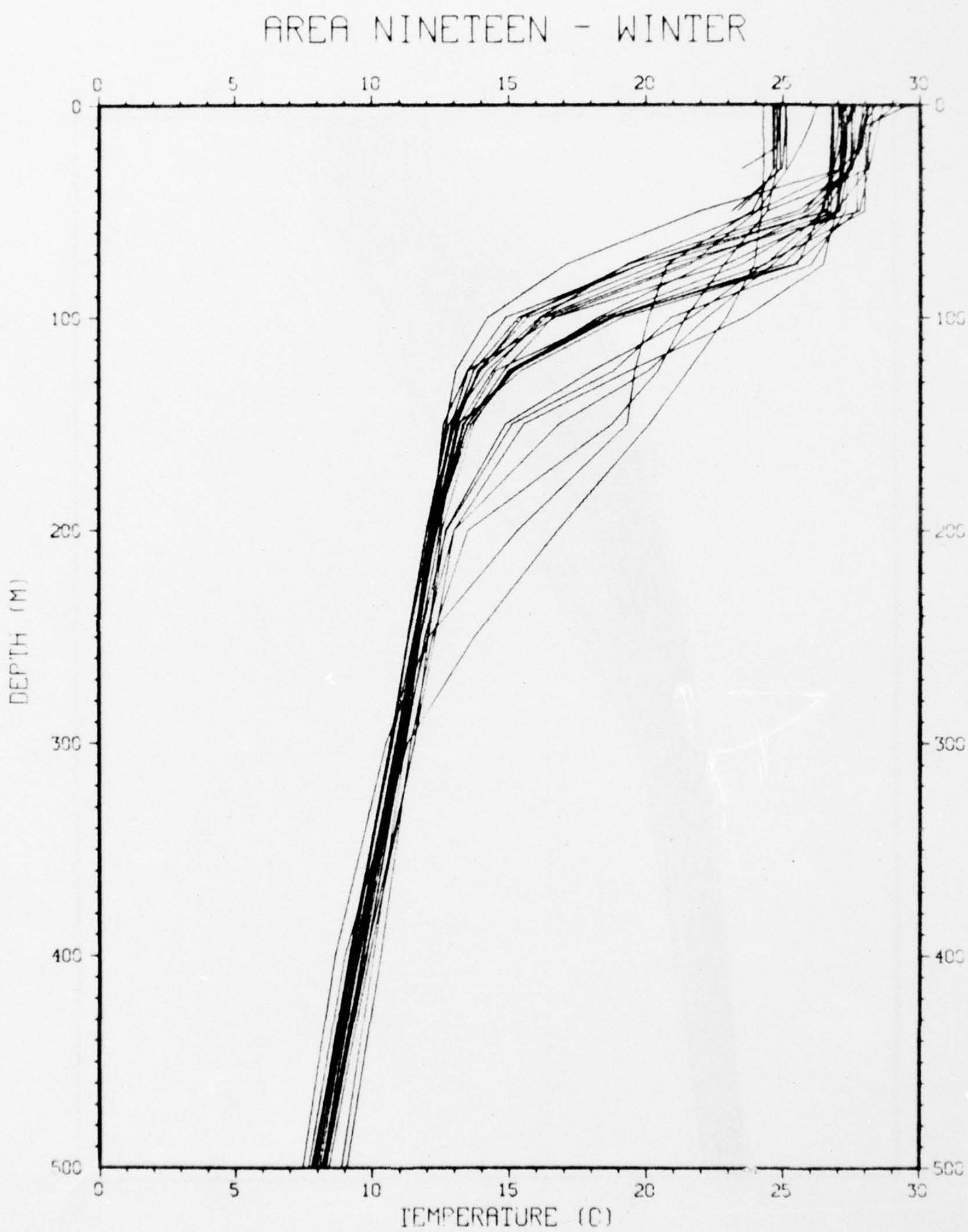

AREA NINETEEN - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.74.

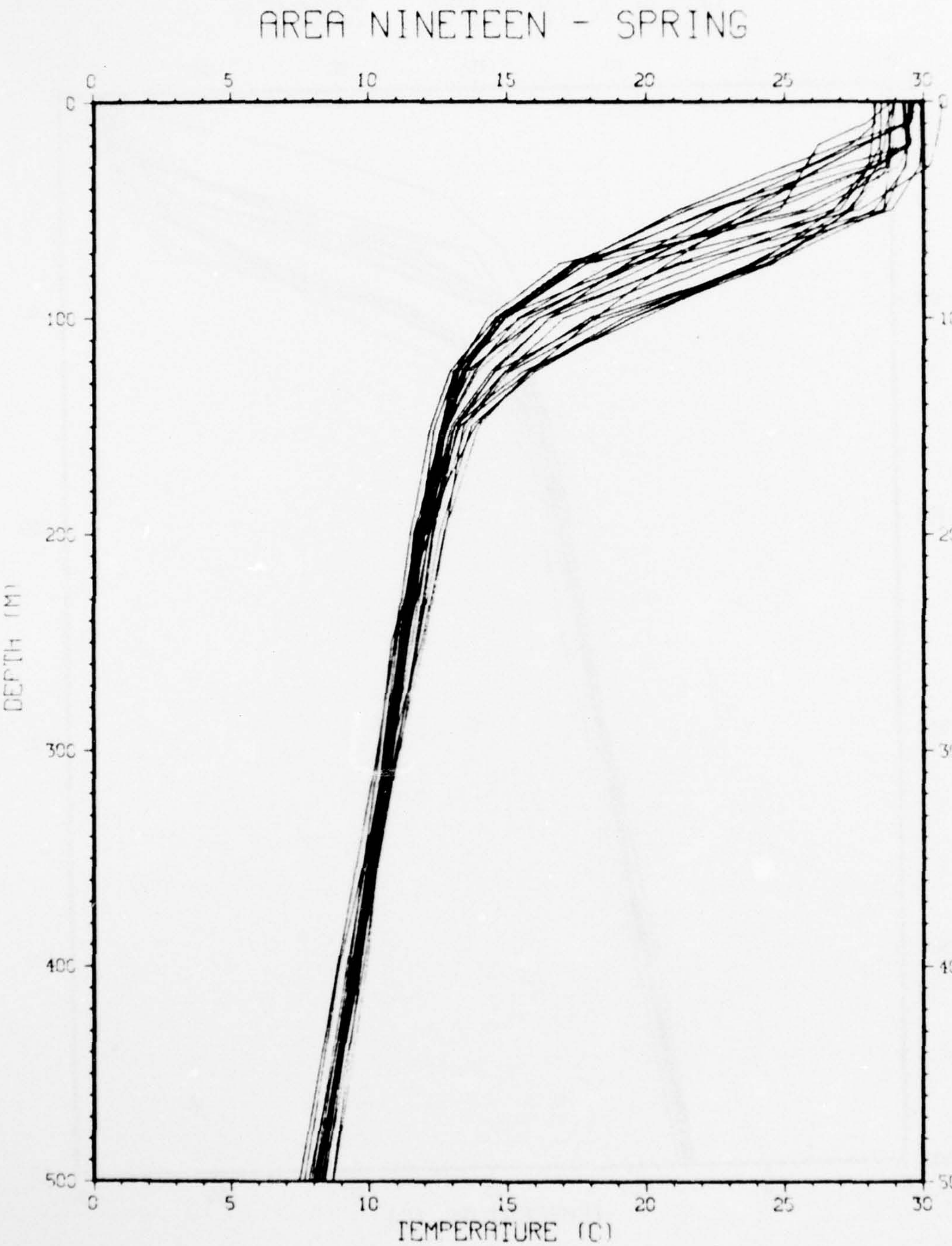

AREA NINETEEN - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.75.

AREA NINETEEN - SUMMER

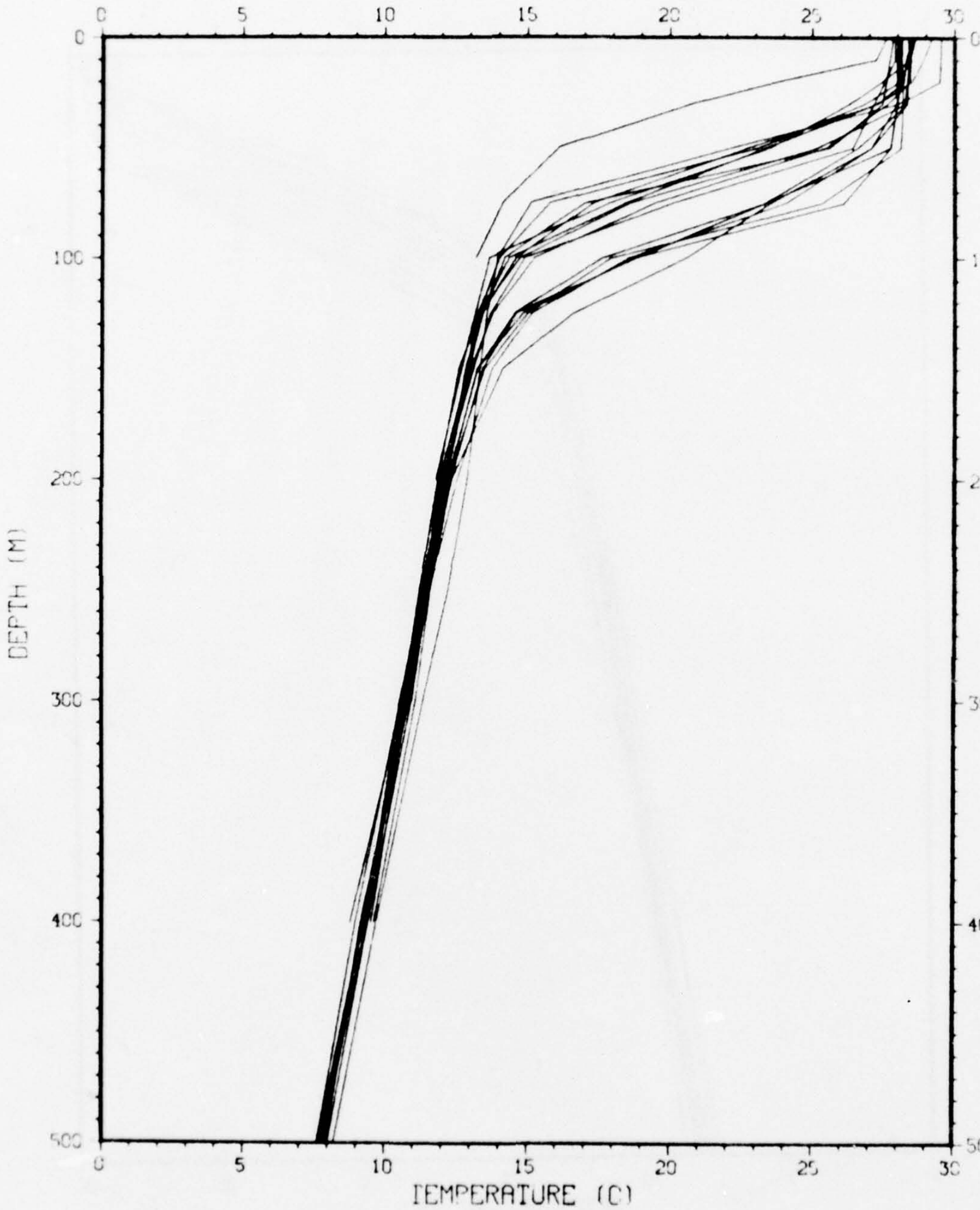


Figure B.76.

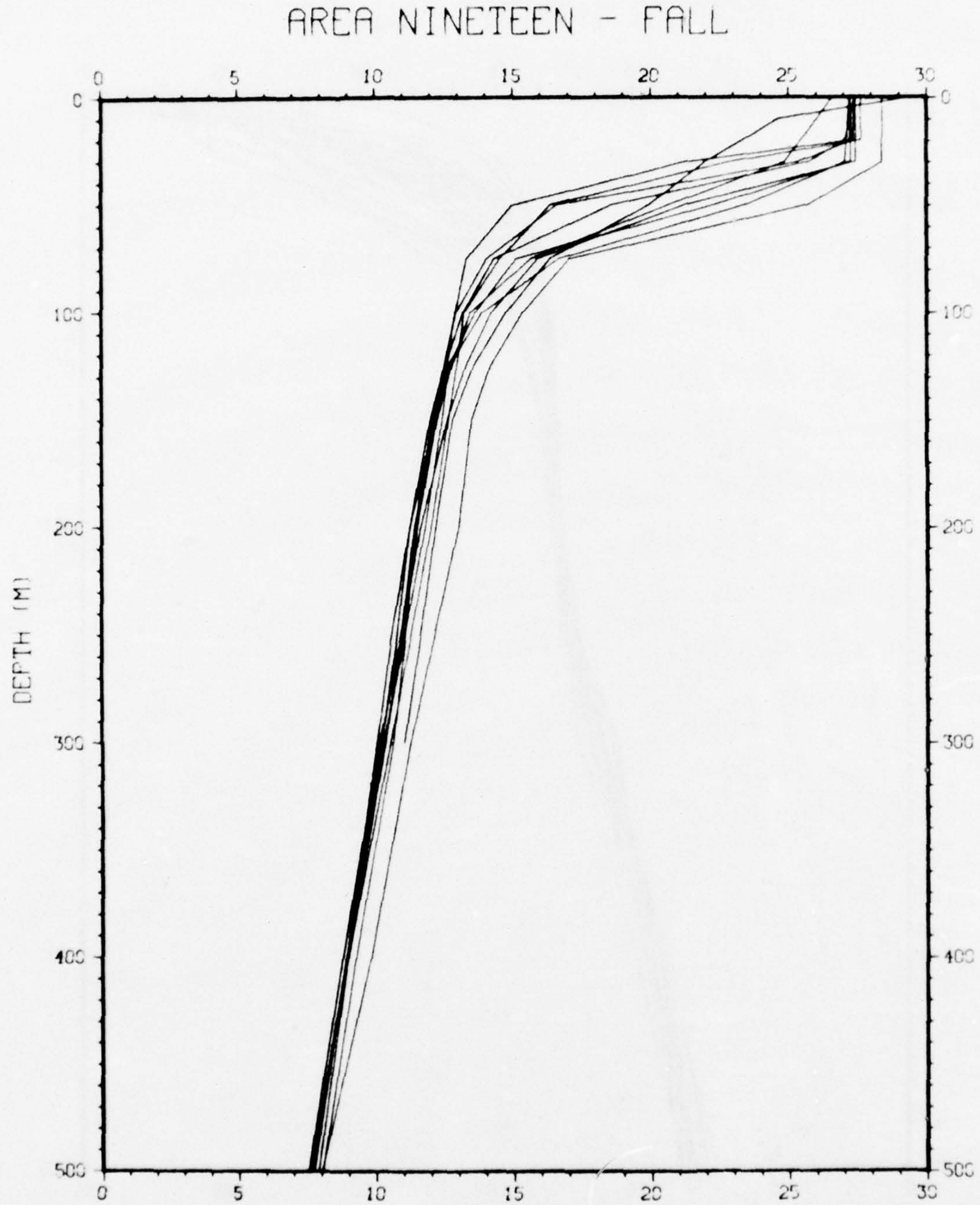
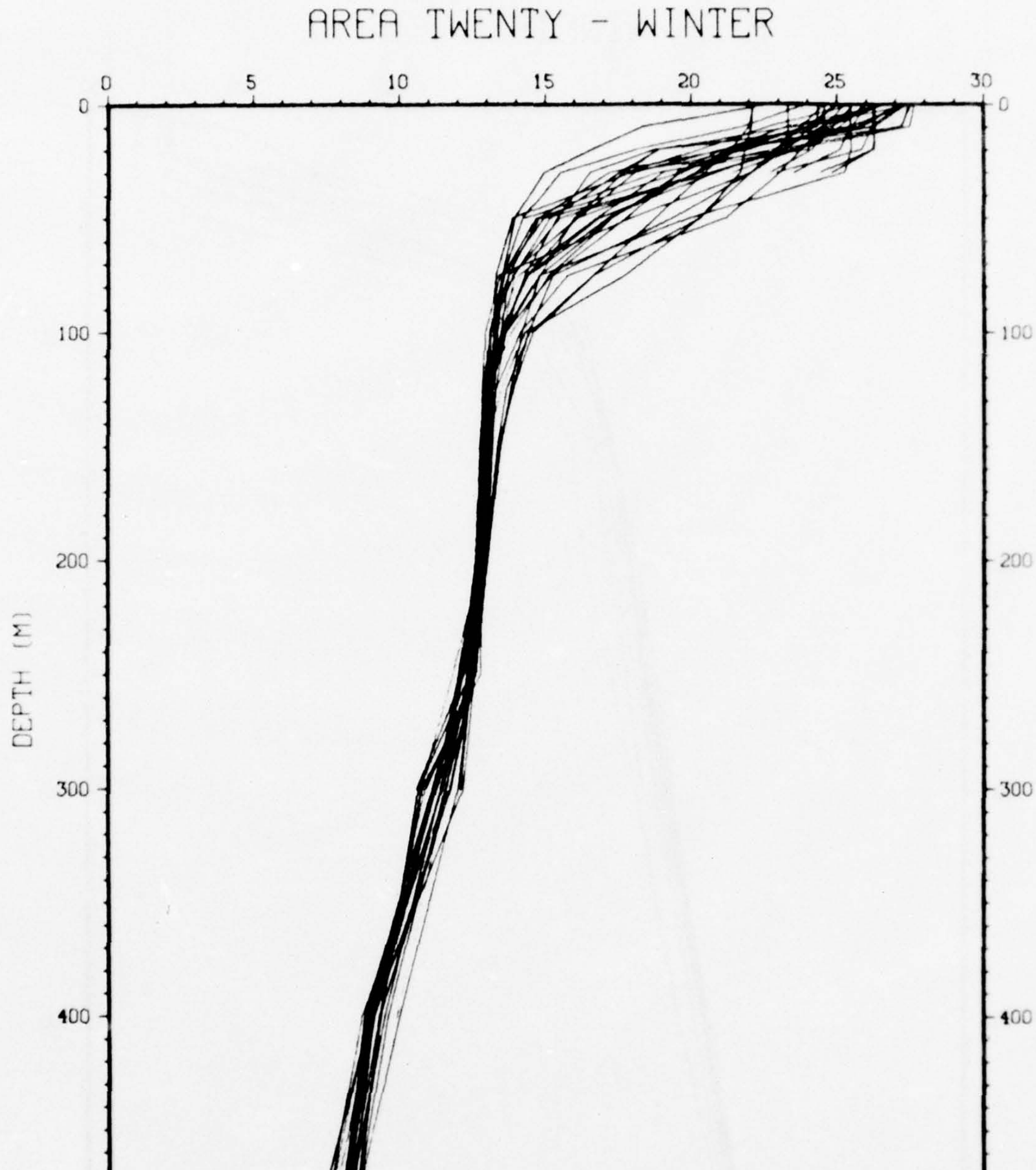
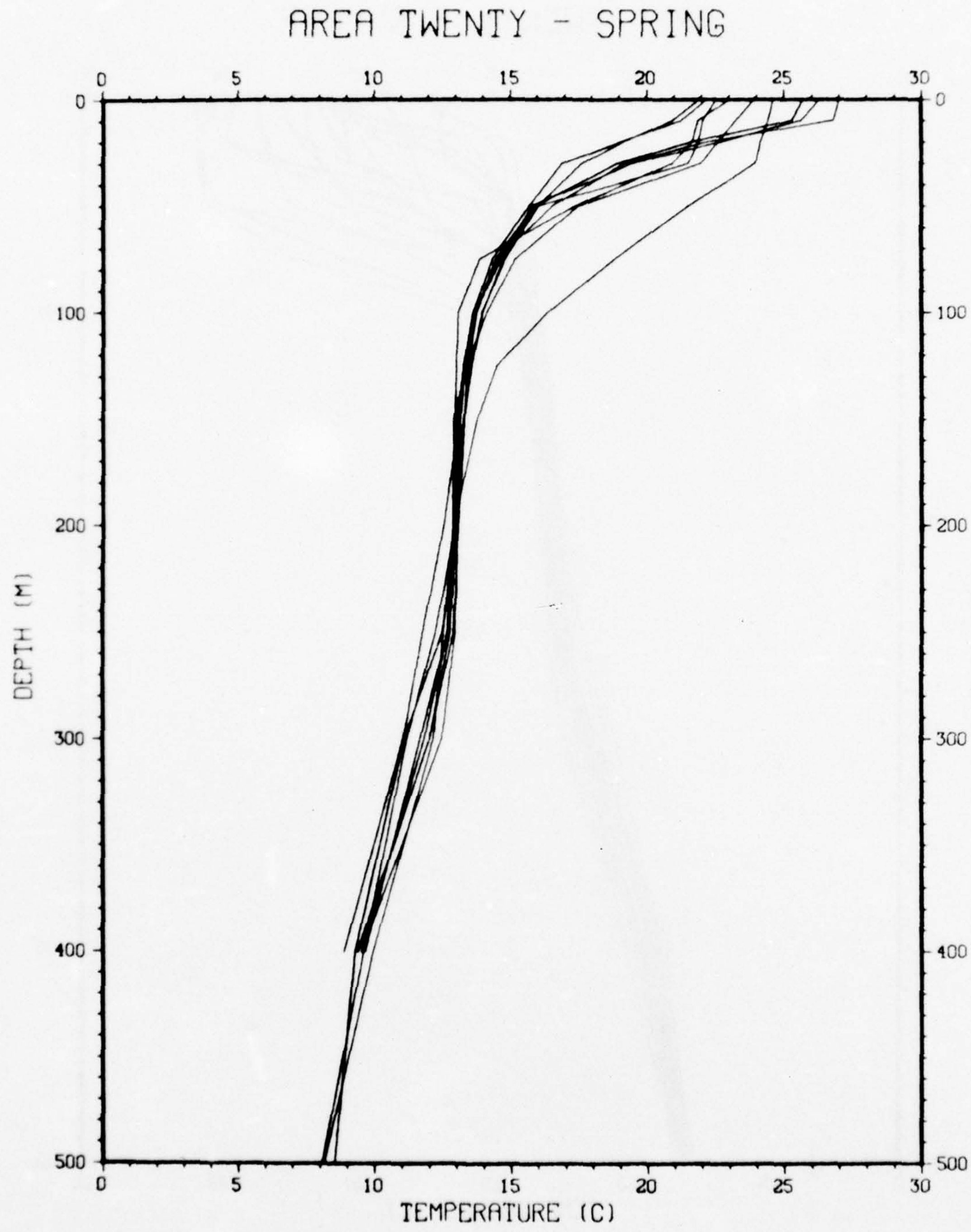

AREA NINETEEN - FALL
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.77.



AREA TWENTY - WINTER
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.78.



AREA TWENTY - SPRING
0
5
10
15
20
25
30
0
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.79.

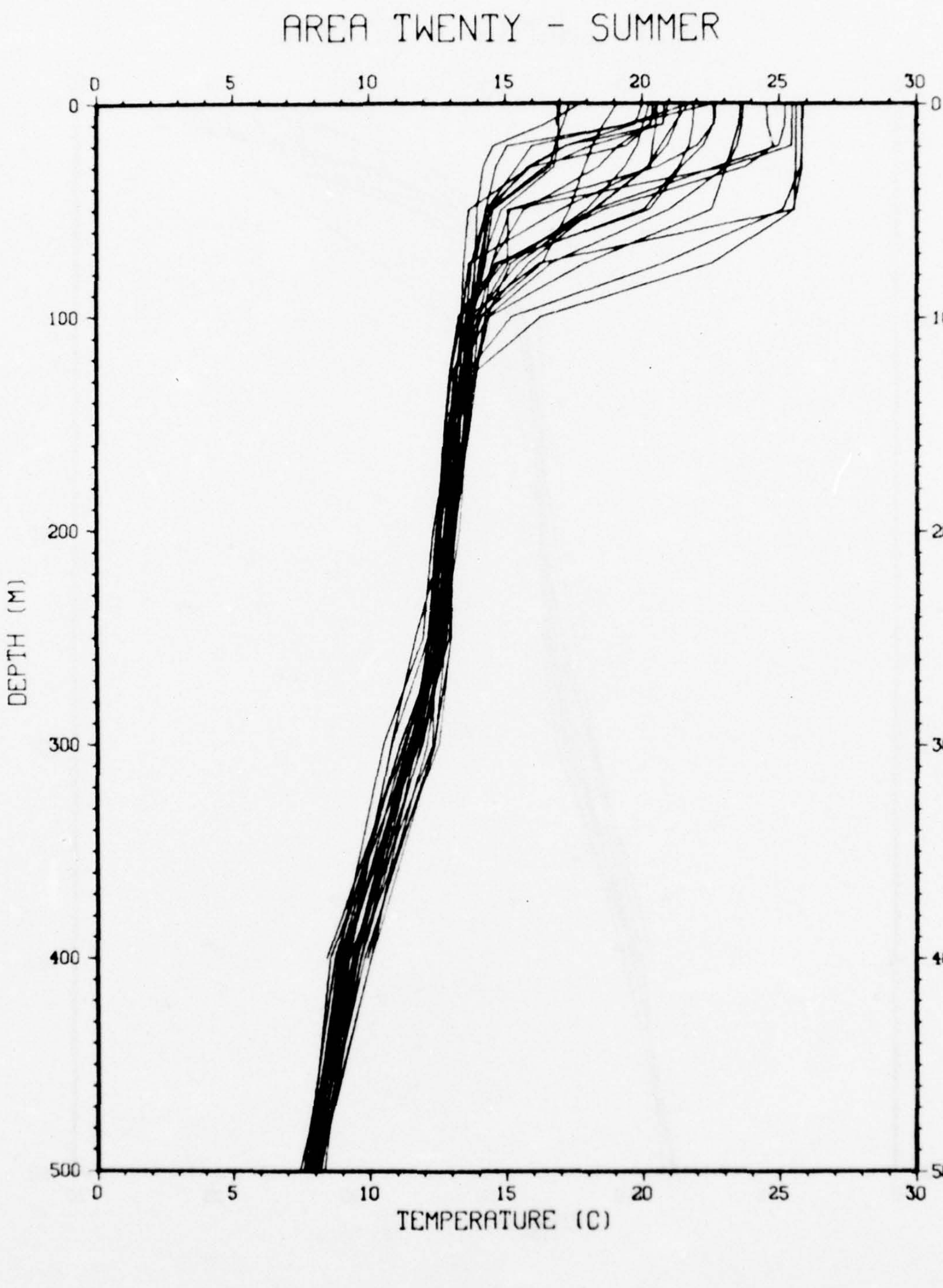

AREA TWENTY - SUMMER
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.80.

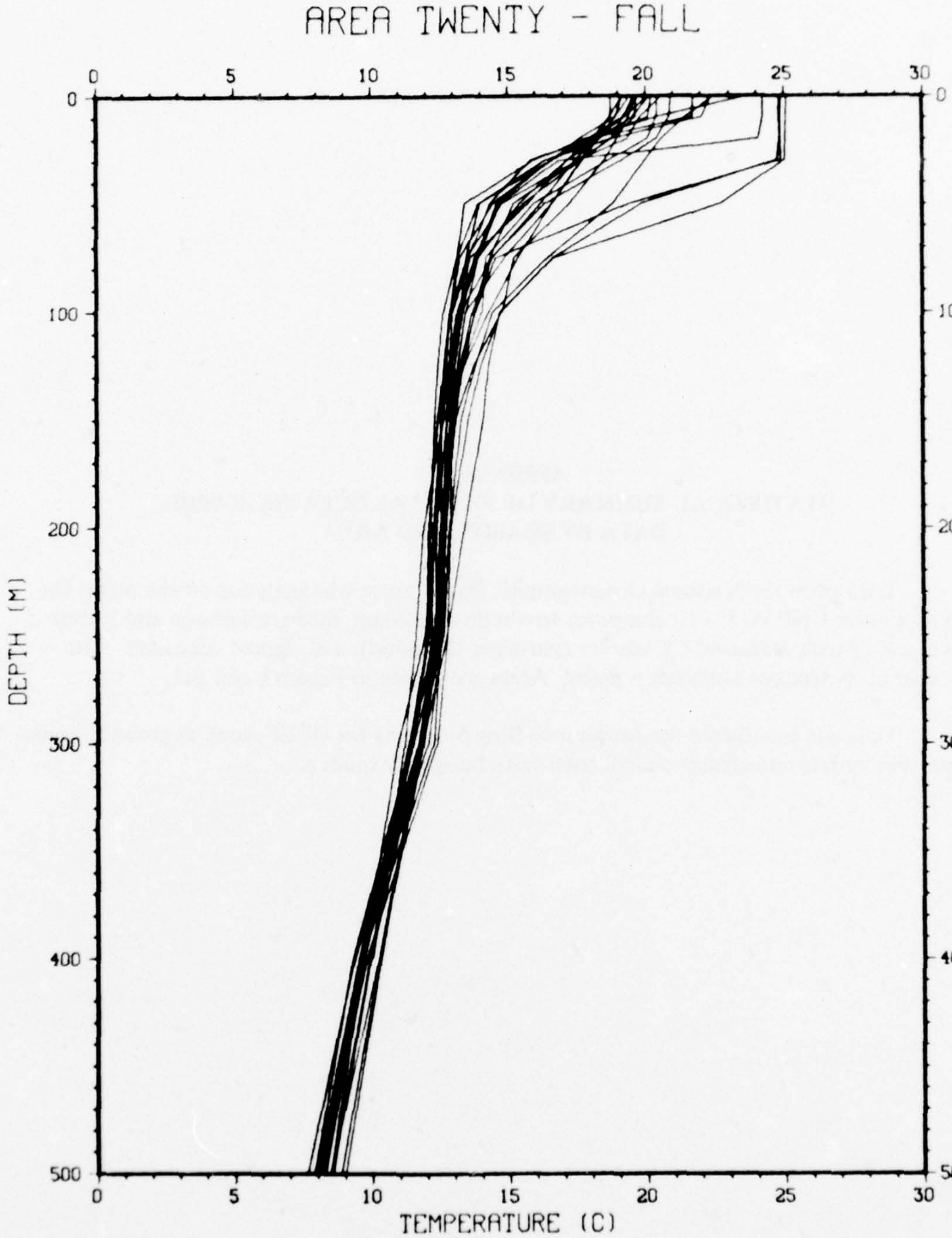

AREA TWENTY - FALL
0
5
10
15
20
25
30
100
200
300
400
500
DEPTH (M)
TEMPERATURE (C)

Figure B.81.

APPENDIX C
STATISTICAL SUMMARY OF PHYSICAL OCEANOGRAPHIC DATA BY SEASON AND AREA

Data from the National Oceanographic Data Center was analyzed on the Naval Undersea Center UNIVAC 1110 computer to obtain maximum, mean, minimum and standard deviation of temperature (°C), salinity (parts per thousand), and sigma-t (density). The number of hydrocasts analyzed is given. Areas are shown in Figure 1 and B.1.

Data can be utilized for future modeling programs for OFEF, such as growth simulation, sinking rate and structural and total farm buoyancy models.

AREA ONE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	17.37	15.37	13.33	1.0785	33.71	33.44	33.02	.1677	25.23	24.602	23.90	.2595	36
10	17.27	14.87	13.03	1.0977	33.71	33.48	32.98	.1760	25.23	24.642	23.91	.2579	38
20	16.75	14.50	11.77	1.2024	33.71	33.48	33.02	.1675	25.33	24.918	24.07	.2674	38
30	16.57	14.02	11.32	1.3104	33.71	33.49	33.18	.1428	25.59	25.025	24.44	.2613	37
50	15.76	12.81	10.41	1.3902	33.71	33.51	33.21	.1167	25.88	25.286	24.77	.2475	37
75	13.20	11.34	9.65	1.0417	33.88	33.62	33.38	.0996	26.14	25.654	25.23	.2376	33
100	11.93	10.17	9.45	.7372	34.01	33.75	33.55	.0977	26.22	25.692	25.57	.1744	25
125	11.57	10.04	9.18	.6014	34.03	33.85	33.61	.0857	26.32	26.064	25.73	.1477	22
150	10.64	9.65	8.83	.4844	34.09	33.96	33.76	.0730	26.37	26.216	25.98	.1103	22
200	10.10	9.22	8.34	.4061	34.25	34.11	33.94	.0768	26.55	26.404	26.29	.0774	18
250	9.25	8.74	8.22	.2955	34.25	34.19	34.03	.0536	26.65	26.541	26.43	.0577	17
300	8.66	8.23	7.73	.2239	34.29	34.22	34.06	.0550	26.73	26.643	26.56	.0551	16
400	7.58	7.36	7.13	.1711	34.30	34.25	34.16	.0366	26.85	26.786	26.71	.0433	11
500	6.57	6.45	6.29	.1190	34.31	34.28	34.25	.0275	26.98	26.930	26.91	.0294	6
600	5.87	5.81	5.75	.0849	34.34	34.34	34.33	.0071	27.07	27.070	27.07	.0000	2

AREA ONE - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	22.96	19.85	15.00	1.7645	33.78	33.54	33.20	.1845	24.62	23.692	22.96	.3960	29
10	21.67	16.91	10.00	2.7356	33.73	33.48	33.20	.1808	25.83	24.357	23.11	.6320	29
20	18.37	14.36	9.67	2.3000	33.71	33.48	33.19	.1596	25.91	24.926	23.79	.5375	27
30	16.26	12.70	9.69	1.7437	33.80	33.47	33.14	.1747	26.00	25.271	24.41	.4404	27
50	14.60	11.38	9.47	1.3467	33.82	33.53	33.23	.1748	26.12	25.571	24.93	.3513	24
75	13.02	10.40	9.57	.8491	33.93	33.66	33.45	.1437	26.20	25.820	25.28	.2404	22
100	12.16	10.28	9.67	.6531	33.95	33.75	33.52	.1399	26.19	25.943	25.46	.2046	21
125	11.04	10.00	9.21	.5069	34.06	33.83	33.59	.1438	26.31	26.057	25.79	.1834	19
150	10.44	9.83	9.02	.3801	34.07	33.90	33.73	.1176	26.36	26.119	25.96	.1380	17
200	10.35	9.47	9.02	.3382	34.27	34.08	33.91	.0984	26.51	26.337	26.14	.0976	16
250	9.51	9.08	8.69	.2618	34.31	34.19	34.04	.0867	26.56	26.492	26.40	.0576	13
300	9.20	8.57	7.67	.4504	34.31	34.24	34.14	.0490	26.66	26.606	26.52	.0439	11
400	8.12	7.61	7.21	.3413	34.36	34.29	34.23	.0450	26.82	26.789	26.75	.0234	7
500	6.64	6.48	6.37	.1370	34.32	34.28	34.23	.0387	26.95	26.942	26.92	.0115	4

AREA ONE - SPRING

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	22.37	17.05	13.89	1.8111	33.81	33.52	32.51	.2356	25.08	24.367	23.20	.4760	41
10	19.28	15.59	12.27	1.7229	33.80	33.52	32.91	.1651	25.33	24.705	23.92	.4002	41
20	15.90	13.26	10.61	1.4219	33.77	33.54	33.27	.1155	25.73	25.218	24.51	.2987	41
30	14.50	12.03	9.85	1.1307	33.75	33.56	33.30	.0989	25.94	25.480	24.98	.2482	41
50	13.35	10.87	9.34	.7837	33.92	33.67	33.43	.1104	26.19	25.815	25.21	.2036	38
75	11.37	9.95	9.18	.4648	34.07	33.81	33.57	.1075	26.35	26.047	25.62	.1505	37
100	10.66	9.67	8.91	.3676	34.08	33.91	33.67	.1077	26.43	26.174	25.82	.1224	27
125	10.07	9.42	8.71	.3097	34.15	34.00	33.80	.1032	26.46	26.279	26.08	.1023	24
150	9.97	9.30	8.64	.3111	34.25	34.07	33.82	.1135	26.48	26.360	26.13	.0991	21
200	9.59	8.95	8.17	.4089	34.31	34.17	34.00	.0747	26.61	26.497	26.36	.0658	18
250	9.19	8.64	7.89	.3744	34.35	34.24	34.06	.0645	26.70	26.596	26.51	.0500	18
300	8.78	8.31	7.57	.3465	34.43	34.29	34.19	.0494	26.77	26.684	26.62	.0460	16
400	7.72	7.22	6.91	.1961	34.34	34.28	34.25	.0269	26.90	26.839	26.79	.0371	15
500	6.61	6.42	6.22	.1331	34.35	34.31	34.27	.0275	27.03	26.967	26.91	.0382	7
600	5.73	5.73	5.72	.0071	34.34	34.34	34.33	.0071	27.08	27.080	27.08	.0000	2

AREA ONE - FALL

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	22.54	18.07	14.09	2.0130	33.81	33.54	33.25	.1432	25.07	24.141	22.95	.4623	28
10	20.68	17.42	14.08	1.8597	33.80	33.52	33.23	.1410	25.07	24.284	23.48	.4084	28
20	18.41	15.40	13.27	1.5264	33.66	33.48	33.25	.1152	25.20	24.626	24.01	.3092	26
30	17.35	14.34	11.41	1.5890	33.60	33.44	33.16	.1097	25.44	24.913	24.32	.3174	26
50	15.14	12.39	10.87	1.2682	33.67	33.47	33.16	.1246	25.66	25.298	24.77	.2529	25
75	13.40	11.41	9.72	.9137	33.75	33.57	33.32	.0985	25.94	25.604	25.23	.1933	24
100	12.31	10.58	9.69	.6832	33.84	33.69	33.42	.0918	26.02	25.789	25.48	.1532	19
125	11.53	10.35	9.28	.5566	33.92	33.80	33.58	.0929	26.21	25.977	25.69	.1369	18
150	11.15	9.96	8.89	.5222	34.02	33.91	33.66	.0997	26.35	26.121	25.87	.1228	18
200	9.87	9.25	8.26	.4570	34.14	34.05	33.90	.0717	26.50	26.345	26.17	.0872	13
250	9.41	8.81	8.09	.4044	34.25	34.16	34.09	.0579	26.64	26.506	26.37	.0731	13
300	9.01	8.32	7.69	.3570	34.26	34.20	34.16	.0340	26.76	26.615	26.50	.0662	10
400	7.67	7.34	7.15	.2126	34.27	34.24	34.21	.0195	26.84	26.794	26.73	.0399	7

Figure C.1.

AREA TWO - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	17.49	14.27	[illegible]	[illegible]	33.69	33.45	33.19	.1536	25.23	24.621	24.01	.2163	38
10	[illegible]	[illegible]	[illegible]	[illegible]	33.69	33.45	33.19	[illegible]	25.34	24.888	24.18	.1986	38
20	15.64	14.26	11.62	1.1245	33.69	33.45	33.17	.1604	[illegible]	24.933	24.16	.2295	38
[illegible]	15.47	13.74	[illegible]	[illegible]	33.69	33.45	33.17	.1517	[illegible]	25.015	24.26	.2579	38
[illegible]	15.62	12.83	[illegible]	1.4265	33.62	33.45	33.13	.1391	25.86	25.236	24.70	.2795	38
75	[illegible]	11.27	9.56	[illegible]	33.78	[illegible]	33.26	.1271	26.13	25.616	25.28	.2256	38
100	[illegible]	10.42	9.12	.7659	34.01	33.69	[illegible]	.1326	26.25	25.672	25.46	.2615	38
[illegible]	[illegible]	9.94	[illegible]	[illegible]	[illegible]	[illegible]	33.60	.1165	26.38	26.068	25.79	.1615	38
150	10.56	9.50	[illegible]	[illegible]	34.12	[illegible]	33.69	.0971	26.46	26.229	25.98	.1276	38
[illegible]	[illegible]	8.11	[illegible]	[illegible]	[illegible]	34.13	[illegible]	[illegible]	26.57	26.413	[illegible]	.0723	37
[illegible]	[illegible]	7.67	[illegible]	[illegible]	[illegible]	34.21	[illegible]	.0699	26.66	26.565	26.45	.0494	37
[illegible]	.78	[illegible]	[illegible]	[illegible]	34.34	[illegible]	34.14	[illegible]	26.75	[illegible]	[illegible]	.0416	36
[illegible]	.11	7.20	[illegible]	[illegible]	[illegible]	34.23	34.15	.0342	26.91	26.623	[illegible]	.0435	36
[illegible]	[illegible]	7.44	7.11	[illegible]	34.36	34.29	[illegible]	.0269	[illegible]	[illegible]	[illegible]	.0416	[illegible]
[illegible]	[illegible]	5.73	[illegible]	.1133	34.42	[illegible]	[illegible]	[illegible]	27.11	27.077	27.01	[illegible]	[illegible]
[illegible]	[illegible]	5.11	[illegible]	[illegible]	34.47	[illegible]	[illegible]	[illegible]	27.21	27.203	27.19	.0115	[illegible]
[illegible]	[illegible]	4.12	[illegible]	[illegible]	34.46	34.46	34.46	[illegible]	[illegible]	27.306	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.36	[illegible]	[illegible]	[illegible]	1

AREA TWO - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.86	33.57	[illegible]	.1566	26.10	25.584	22.92	[illegible]	33
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.20	[illegible]	[illegible]	25.887	23.11	[illegible]	32
20	[illegible]	[illegible]	[illegible]	1.7961	33.69	33.42	33.15	.1574	25.74	24.566	23.69	.4471	32
30	[illegible]	15.91	[illegible]	[illegible]	33.65	33.42	32.98	.1761	25.71	24.990	24.13	[illegible]	32
50	[illegible]	[illegible]	[illegible]	[illegible]	33.73	33.45	[illegible]	.1635	25.93	25.425	24.77	.2835	32
75	[illegible]	[illegible]	[illegible]	[illegible]	33.91	33.61	33.28	[illegible]	26.13	[illegible]	25.32	.2170	32
100	[illegible]	9.29	[illegible]	[illegible]	[illegible]	33.73	33.35	.1441	26.23	25.995	25.62	.1796	31
125	10.69	9.49	[illegible]	[illegible]	34.17	[illegible]	33.59	[illegible]	26.34	[illegible]	25.86	[illegible]	31
150	[illegible]	9.42	8.72	[illegible]	34.27	[illegible]	33.76	.1178	26.42	26.244	25.96	[illegible]	31
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.96	.0966	26.57	26.417	[illegible]	.1035	31
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.21	34.01	[illegible]	26.73	26.540	26.36	.0767	31
[illegible]	9.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.77	26.628	26.51	[illegible]	31
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.29	34.18	.0462	26.87	26.796	[illegible]	.0331	31
[illegible]	[illegible]	6.73	[illegible]	[illegible]	34.38	34.31	[illegible]	[illegible]	27.03	26.911	26.81	[illegible]	[illegible]
600	[illegible]	5.99	[illegible]	[illegible]	34.39	[illegible]	34.26	.0479	27.13	27.056	26.98	.0544	7
[illegible]	[illegible]	5.44	[illegible]	[illegible]	[illegible]	34.41	[illegible]	[illegible]	27.27	27.173	27.12	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.1527	[illegible]	34.47	34.43	[illegible]	27.36	[illegible]	27.25	[illegible]	3
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.56	34.47	[illegible]	[illegible]	[illegible]	27.340	27.26	.0849	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.51	34.47	34.44	[illegible]	27.43	[illegible]	27.34	[illegible]	2

AREA TWO - SPRING

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	11.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1542	25.01	24.622	[illegible]	[illegible]	46
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.06	24.547	[illegible]	[illegible]	46
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.47	33.11	.1422	25.66	[illegible]	24.11	.2712	45
[illegible]	16.34	[illegible]	[illegible]	[illegible]	[illegible]	33.47	[illegible]	[illegible]	25.94	[illegible]	24.37	[illegible]	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.67	33.52	[illegible]	.1149	[illegible]	25.606	25.09	.2195	45
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1321	[illegible]	25.907	[illegible]	.1660	45
[illegible]	[illegible]	9.27	[illegible]	[illegible]	[illegible]	33.86	33.62	[illegible]	[illegible]	26.115	25.75	.1261	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.16	[illegible]	33.79	[illegible]	26.43	[illegible]	[illegible]	.0982	45
[illegible]	[illegible]	9.11	[illegible]	.2217	34.21	[illegible]	33.92	[illegible]	26.52	26.371	26.16	.0723	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.519	[illegible]	.0569	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.624	[illegible]	.0418	45
[illegible]	[illegible]	7.97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0476	26.79	26.714	26.57	[illegible]	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.95	[illegible]	26.72	.0412	42
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.41	34.31	[illegible]	[illegible]	27.06	26.976	26.91	[illegible]	39
[illegible]	[illegible]	5.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0377	27.16	27.097	[illegible]	.0429	12
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.43	[illegible]	[illegible]	.0141	27.19	[illegible]	27.19	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.43	[illegible]	[illegible]	27.27	[illegible]	27.27	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.46	[illegible]	[illegible]	27.34	27.340	27.34	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.42	34.42	[illegible]	27.29	[illegible]	27.29	[illegible]	1

AREA TWO - FALL

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1562	[illegible]	24.116	[illegible]	[illegible]	32
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.52	[illegible]	[illegible]	[illegible]	24.164	23.26	[illegible]	32
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.46	33.19	.1464	[illegible]	24.376	23.71	[illegible]	30
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.42	[illegible]	[illegible]	25.23	[illegible]	23.92	.3414	30
[illegible]	[illegible]	13.17	[illegible]	[illegible]	[illegible]	33.29	33.11	[illegible]	[illegible]	25.121	24.33	.2944	29
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.07	[illegible]	29
[illegible]	[illegible]	10.22	[illegible]	[illegible]	[illegible]	33.66	[illegible]	[illegible]	26.11	25.767	25.37	[illegible]	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.58	[illegible]	26.25	[illegible]	[illegible]	.1727	29
150	11.44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.64	.1066	26.35	26.112	25.83	.1421	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.341	[illegible]	[illegible]	28
[illegible]	[illegible]	8.72	[illegible]	[illegible]	34.27	34.16	[illegible]	[illegible]	26.75	26.516	[illegible]	.0718	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.79	26.692	26.55	.0492	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.27	[illegible]	[illegible]	26.94	26.829	26.77	.0422	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.41	[illegible]	[illegible]	[illegible]	27.05	26.975	26.91	.0364	27
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.37	34.33	[illegible]	27.13	27.097	27.07	.0269	7

Figure C.2.

AREA THREE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	16.74	14.77	[illegible]	[illegible]	33.73	33.62	[illegible]	[illegible]	25.17	24.851	24.21	.1986	32
10	16.77	14.69	[illegible]	.9459	[illegible]	33.47	[illegible]	.1417	25.16	24.869	24.23	.1964	32
20	[illegible]	[illegible]	[illegible]	.9772	33.68	33.47	[illegible]	[illegible]	25.22	24.911	24.26	.2217	32
30	16.41	[illegible]	[illegible]	[illegible]	33.68	33.47	[illegible]	[illegible]	25.31	24.965	24.41	.1991	32
50	16.33	13.23	[illegible]	1.3111	33.67	33.47	33.18	.1112	25.56	25.162	24.62	.2258	32
75	16.47	[illegible]	[illegible]	1.1491	33.65	33.51	33.23	.1116	[illegible]	25.491	24.90	.2381	32
100	[illegible]	[illegible]	9.67	.7126	33.64	33.53	[illegible]	.1061	[illegible]	25.792	[illegible]	.1757	31
125	[illegible]	9.81	[illegible]	[illegible]	[illegible]	33.77	[illegible]	.1061	26.29	26.072	25.63	[illegible]	31
150	10.64	9.44	[illegible]	.4410	34.08	33.79	33.69	.0936	26.39	26.176	25.86	.1195	31
200	9.54	[illegible]	[illegible]	.2764	[illegible]	34.06	[illegible]	.0617	26.59	26.436	26.26	.0742	31
250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	.0479	26.67	[illegible]	26.52	.0476	31
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.77	[illegible]	[illegible]	.0427	30
400	7.24	6.96	6.67	[illegible]	34.34	[illegible]	[illegible]	[illegible]	26.73	26.657	26.73	[illegible]	29
500	[illegible]	[illegible]	[illegible]	.1616	[illegible]	[illegible]	[illegible]	[illegible]	27.06	[illegible]	[illegible]	[illegible]	29
600	6.26	[illegible]	[illegible]	.1915	[illegible]	34.35	[illegible]	[illegible]	27.17	27.096	26.96	.0422	19
700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0190	27.23	27.199	[illegible]	.0411	11
800	[illegible]	[illegible]	[illegible]	[illegible]	34.45	34.43	34.40	.0214	[illegible]	27.273	[illegible]	[illegible]	11
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
1000	4.19	[illegible]	[illegible]	.1122	[illegible]	34.47	34.41	[illegible]	27.41	27.376	27.32	[illegible]	10
1100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.49	[illegible]	[illegible]	27.46	27.419	[illegible]	.0351	10
1200	[illegible]	[illegible]	3.44	[illegible]	[illegible]	34.49	[illegible]	.0261	[illegible]	[illegible]	[illegible]	[illegible]	5
1300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0100	3
1400	[illegible]	[illegible]	[illegible]	[illegible]	34.57	34.55	34.55	[illegible]	[illegible]	27.537	27.53	.0115	3
1500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.57	34.56	[illegible]	[illegible]	[illegible]	27.56	[illegible]	3
1750	2.81	2.81	[illegible]	[illegible]	34.59	34.59	34.59	[illegible]	27.61	27.610	27.61	.0000	1
2000	[illegible]	[illegible]	[illegible]	[illegible]	34.65	34.65	34.65	[illegible]	27.62	27.620	27.62	.0000	1

AREA THREE - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	[illegible]	12.86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.893	[illegible]	.2611	25
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1519	24.76	[illegible]	[illegible]	.3116	25
20	[illegible]	16.93	12.04	[illegible]	[illegible]	33.46	[illegible]	.1416	24.92	24.370	[illegible]	.3856	24
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.21	24.701	[illegible]	.4290	24
50	15.45	12.27	[illegible]	[illegible]	33.66	33.42	[illegible]	.1615	25.62	25.191	24.55	.3042	24
75	[illegible]	11.56	[illegible]	[illegible]	[illegible]	33.49	[illegible]	[illegible]	[illegible]	25.675	[illegible]	[illegible]	24
100	11.21	[illegible]	[illegible]	[illegible]	33.87	33.66	[illegible]	[illegible]	26.13	[illegible]	[illegible]	.2162	24
125	[illegible]	9.58	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1496	26.29	26.107	25.70	[illegible]	24
150	[illegible]	9.12	[illegible]	[illegible]	34.12	33.93	[illegible]	[illegible]	26.40	26.265	26.01	.1006	24
200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.08	[illegible]	[illegible]	[illegible]	26.445	[illegible]	.0659	24
250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.67	26.588	[illegible]	.0437	24
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.656	[illegible]	.0426	23
400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.26	34.19	[illegible]	[illegible]	26.865	26.77	.0389	22
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.05	26.986	[illegible]	.0375	22
600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.37	34.22	[illegible]	27.16	27.102	27.05	.0387	6
700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.21	27.190	27.16	.0265	3
800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.43	34.29	[illegible]	27.27	27.257	27.25	.0115	3
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.43	[illegible]	.0212	27.33	27.310	27.29	.0283	2
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.355	[illegible]	[illegible]	2
1100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.47	[illegible]	[illegible]	27.43	27.400	[illegible]	.0424	2

AREA THREE - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	17.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1667	[illegible]	24.670	[illegible]	[illegible]	25
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.17	.1679	25.11	24.729	24.06	[illegible]	25
20	16.41	14.45	[illegible]	[illegible]	[illegible]	33.46	33.18	.1269	[illegible]	24.921	24.29	.2818	25
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.2683	25
50	[illegible]	11.64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1047	[illegible]	[illegible]	24.95	.2544	26
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.2123	26
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1062	26.28	26.064	[illegible]	.1596	26
125	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.39	[illegible]	[illegible]	[illegible]	22
150	[illegible]	[illegible]	[illegible]	[illegible]	34.12	[illegible]	[illegible]	[illegible]	[illegible]	26.373	[illegible]	.0835	22
200	[illegible]	8.44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.547	[illegible]	[illegible]	21
250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.11	[illegible]	[illegible]	[illegible]	26.55	[illegible]	21
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.747	[illegible]	[illegible]	21
400	[illegible]	6.52	[illegible]	[illegible]	[illegible]	34.29	[illegible]	.0277	[illegible]	[illegible]	[illegible]	.0417	21
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.015	[illegible]	.0463	21
600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.15	27.107	27.07	.0235	8
700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.19	27.168	27.15	.0171	4
800	4.67	[illegible]	[illegible]	[illegible]	34.44	[illegible]	[illegible]	[illegible]	27.29	27.242	27.20	.0377	4
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.41	[illegible]	[illegible]	[illegible]	27.303	27.25	.0551	3
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.41	27.375	27.34	.0495	2
1100	3.77	[illegible]	[illegible]	[illegible]	[illegible]	34.49	[illegible]	[illegible]	27.46	27.425	[illegible]	.0495	2
1200	3.54	[illegible]	[illegible]	.0283	34.57	34.51	34.48	.0495	27.50	27.465	27.43	.0495	2
1300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.53	27.530	27.53	.0000	1
1400	[illegible]	3.08	[illegible]	[illegible]	34.57	34.57	34.57	[illegible]	27.56	27.560	27.56	.0000	1
1500	[illegible]	[illegible]	[illegible]	[illegible]	34.59	34.59	34.59	[illegible]	27.58	27.580	27.58	.0000	1

AREA THREE - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	21.28	18.17	14.29	[illegible]	33.61	33.51	33.17	[illegible]	25.06	24.127	23.36	.3253	22
10	[illegible]	17.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.07	24.155	23.37	.4044	22
20	19.29	16.86	[illegible]	1.5312	33.66	[illegible]	[illegible]	.1100	25.16	24.404	23.83	.3698	22
30	17.79	15.90	[illegible]	1.5866	[illegible]	33.44	33.17	[illegible]	25.45	24.665	24.09	.3659	22
50	14.65	12.97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1566	25.75	25.147	24.75	.2790	22
75	12.98	11.27	[illegible]	.9862	33.69	33.47	[illegible]	.1468	25.96	25.549	[illegible]	[illegible]	22
100	[illegible]	10.26	[illegible]	.7269	[illegible]	[illegible]	33.44	[illegible]	[illegible]	[illegible]	25.36	.1751	21
125	10.77	9.76	[illegible]	.5373	33.94	[illegible]	[illegible]	.0987	26.31	[illegible]	[illegible]	.1343	21
150	10.31	9.29	[illegible]	.5476	[illegible]	33.92	33.76	[illegible]	[illegible]	26.251	26.04	.1171	21
200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0561	[illegible]	26.470	26.27	.0829	21
250	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	[illegible]	26.73	26.607	26.44	.0709	21
300	[illegible]	7.72	[illegible]	[illegible]	34.34	[illegible]	[illegible]	[illegible]	[illegible]	26.714	[illegible]	.0665	21
400	[illegible]	6.97	[illegible]	[illegible]	[illegible]	34.27	[illegible]	[illegible]	26.96	26.868	[illegible]	[illegible]	21
500	6.71	6.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0367	27.11	26.999	[illegible]	.0419	21
600	5.87	5.61	[illegible]	.1736	34.35	[illegible]	[illegible]	.0176	27.15	27.117	27.07	.0266	6
700	5.16	[illegible]	[illegible]	[illegible]	[illegible]	34.40	[illegible]	[illegible]	27.25	27.217	[illegible]	.0294	3
800	4.71	[illegible]	[illegible]	[illegible]	34.46	34.42	34.41	.0265	27.32	27.283	27.26	.0321	3
900	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.37	27.343	27.33	.0271	3
1000	[illegible]	[illegible]	[illegible]	[illegible]	34.50	34.47	34.46	.0112	27.43	27.392	27.38	.0102	3
1100	3.72	[illegible]	[illegible]	[illegible]	[illegible]	34.49	[illegible]	.0233	27.45	27.437	27.42	.0115	3

Figure C.3.

AREA FOUR - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	17.42	14.74	12.17	[illegible]	33.20	[illegible]	[illegible]	.1628	25.25	24.924	[illegible]	.2281	40
10	[illegible]	14.71	12.17	[illegible]	33.68	33.47	33.17	.1637	25.51	24.947	24.28	.2091	40
[illegible]	16.50	14.10	12.17	.9810	33.67	33.47	33.18	.1581	25.40	24.983	24.31	.1957	40
[illegible]	16.27	[illegible]	[illegible]	[illegible]	33.69	33.48	33.18	.1567	25.60	25.040	24.39	.2270	40
[illegible]	16.27	12.45	[illegible]	1.4697	33.72	33.46	33.12	.1447	25.96	25.231	24.66	.2707	40
[illegible]	[illegible]	[illegible]	[illegible]	1.1722	[illegible]	33.43	33.11	.1772	26.18	25.590	24.96	.2491	40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.92	33.45	[illegible]	.1321	26.33	25.666	[illegible]	.1657	39
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.79	[illegible]	.1114	26.43	26.077	25.76	.1676	39
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.96	33.56	.0967	26.55	26.246	25.95	.1106	39
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.456	[illegible]	.0716	39
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.16	34.07	[illegible]	26.73	26.594	[illegible]	.0500	37
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	26.81	26.696	26.61	.0472	37
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.26	34.21	[illegible]	[illegible]	26.853	26.72	[illegible]	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.34	[illegible]	[illegible]	.0231	27.03	26.996	26.91	[illegible]	35
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.33	[illegible]	.0237	27.13	27.086	27.04	.0176	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.38	34.36	[illegible]	27.23	[illegible]	[illegible]	.0159	35
[illegible]	[illegible]	4.87	[illegible]	[illegible]	34.50	34.43	[illegible]	.0231	[illegible]	27.277	[illegible]	[illegible]	35
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.46	34.43	.0196	27.37	27.317	[illegible]	.0167	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.48	34.43	.0180	[illegible]	[illegible]	[illegible]	.0166	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.45	.0108	27.42	[illegible]	27.37	.0144	12
[illegible]	3.79	3.76	[illegible]	[illegible]	34.47	34.46	34.46	[illegible]	27.42	27.415	27.41	.0071	2
[illegible]	[illegible]	3.73	[illegible]	[illegible]	[illegible]	[illegible]	34.50	[illegible]	27.43	27.430	27.43	.0000	1
1400	3.73	3.73	3.73	[illegible]	34.50	34.50	34.50	[illegible]	27.43	27.430	27.43	.0000	1
[illegible]	3.73	[illegible]	3.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.43	27.430	27.43	.0000	1

AREA FOUR - SUMMER

[illegible]	[illegible]	15.82	11.12	[illegible]	33.32	[illegible]	[illegible]	.1678	26.83	[illegible]	[illegible]	[illegible]	35
[illegible]	17.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1660	25.15	24.194	[illegible]	.2696	[illegible]
[illegible]	[illegible]	15.62	12.13	1.7421	33.67	[illegible]	33.17	.1625	25.64	24.720	23.90	.4291	35
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.190	24.59	[illegible]	[illegible]
[illegible]	[illegible]	11.21	9.26	[illegible]	[illegible]	[illegible]	[illegible]	.1670	26.21	25.660	24.82	.3176	35
[illegible]	11.56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1417	[illegible]	25.976	[illegible]	.1983	35
[illegible]	[illegible]	9.26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1126	26.65	[illegible]	[illegible]	.1331	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	8.72	[illegible]	[illegible]	34.19	[illegible]	[illegible]	.0834	[illegible]	26.413	26.26	[illegible]	34
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.77	26.663	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0416	[illegible]	26.766	[illegible]	.0467	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.996	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.66	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.324	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0419	27.44	[illegible]	27.37	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.41	[illegible]	27.41	[illegible]	1
1400	[illegible]	3.76	3.76	[illegible]	34.48	[illegible]	34.48	[illegible]	27.44	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.42	[illegible]	[illegible]	[illegible]	1

AREA FOUR - SPRING

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.76	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.16	[illegible]	25.76	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1716	26.27	[illegible]	24.57	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1667	[illegible]	[illegible]	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1437	[illegible]	26.171	[illegible]	[illegible]	44
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1437	43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.61	26.420	[illegible]	[illegible]	43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.73	26.575	[illegible]	[illegible]	42
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.677	[illegible]	[illegible]	42
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.766	[illegible]	.0441	42
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.854	[illegible]	[illegible]	41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.05	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.15	[illegible]	[illegible]	.0371	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.175	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.41	[illegible]	[illegible]	27.30	[illegible]	27.22	.0227	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.44	[illegible]	[illegible]	27.375	[illegible]	.0252	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.49	[illegible]	[illegible]	27.42	[illegible]	[illegible]	[illegible]	4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.51	[illegible]	[illegible]	[illegible]	27.43	27.427	27.42	[illegible]	3

AREA FOUR - FALL

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.61	[illegible]	[illegible]	[illegible]	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.27	[illegible]	25.61	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.49	[illegible]	[illegible]	25.62	[illegible]	23.66	[illegible]	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	36
[illegible]	16.41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.16	[illegible]	25.91	[illegible]	[illegible]	[illegible]	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.25	[illegible]	[illegible]	[illegible]	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.87	[illegible]	[illegible]
[illegible]	[illegible]	9.11	[illegible]	[illegible]	34.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.36	[illegible]	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	.0641	26.73	26.613	26.53	[illegible]	32
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.81	[illegible]	26.62	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.855	26.77	[illegible]	32
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.03	[illegible]	26.91	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.12	27.097	[illegible]	[illegible]	16
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.15	[illegible]	10
[illegible]	[illegible]	4.71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0316	27.31	27.277	27.23	.0275	10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.56	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.28	[illegible]	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0259	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.49	[illegible]	[illegible]	27.43	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3.83	[illegible]	[illegible]	[illegible]	34.48	34.48	[illegible]	27.41	27.410	27.41	[illegible]	1
[illegible]	[illegible]	3.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.42	27.420	27.42	[illegible]	1
1400	[illegible]	3.73	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.43	27.430	27.43	.0000	1

Figure C.4.

AREA FIVE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	16.27	14.15	[illegible]	1.2622	33.3[illegible]	[illegible]	33.12	.1592	25.2[illegible]	24.8[illegible]	[illegible]	[illegible]	26
10	15.76	14.[illegible]	12.1[illegible]	.99[illegible]	[illegible]	[illegible]	[illegible]	.1497	25.2[illegible]	24.9[illegible]	[illegible]	.22[illegible]	26
20	15.69	13.87	12.[illegible]	1.61[illegible]	[illegible]	[illegible]	[illegible]	.1572	25.2[illegible]	24.977	24.77	.22[illegible]	26
30	15.5[illegible]	13.[illegible]1	11.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.161[illegible]	25.61	25.[illegible]26	24.[illegible]6	[illegible]	[illegible]
50	15.2[illegible]	12.69	[illegible]	1.[illegible]912	[illegible]	33.29	[illegible]	.154[illegible]	25.7[illegible]	[illegible]	24.6[illegible]	.2721	26
75	15.1[illegible]	11.78	9.[illegible]	[illegible]	33.7[illegible]	33.46	[illegible]	.153[illegible]	26.0[illegible]	25.373	[illegible]	[illegible]	[illegible]
100	11.36	10.[illegible]	9.[illegible]	[illegible]	33.9[illegible]	[illegible]	[illegible]	[illegible]	26.3[illegible]	25.8[illegible]	[illegible]	[illegible]	21
125	[illegible]	9.[illegible]	[illegible]	.4456	33.9[illegible]	33.75	33.44	[illegible]	[illegible]	26.[illegible]67	[illegible]	.1[illegible]	[illegible]
150	[illegible]	9.1[illegible]	8.4[illegible]	.[illegible]971	[illegible]	33.97	33.64	.096[illegible]	26.6[illegible]	26.236	[illegible]	[illegible]	[illegible]
200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.4[illegible]	[illegible]	[illegible]	19
250	[illegible]	[illegible]	[illegible]	[illegible]	34.1[illegible]	34.1[illegible]	[illegible]	[illegible]	26.67	[illegible]	[illegible]	[illegible]	[illegible]
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.77	26.71[illegible]	[illegible]	[illegible]	17
400	[illegible]	7.5[illegible]	7.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.9[illegible]	26.[illegible]	[illegible]	[illegible]	[illegible]
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.9[illegible]	[illegible]	[illegible]	12
600	[illegible]	[illegible]	5.7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.17	27.09[illegible]	[illegible]	[illegible]	[illegible]
700	[illegible]	5.62	5.27	.1442	[illegible]	[illegible]	34.21	[illegible]	27.2[illegible]	27.1[illegible]	[illegible]	[illegible]	[illegible]
800	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.3[illegible]	27.2[illegible]	27.23	[illegible]	[illegible]
900	[illegible]	4.71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.3[illegible]	27.3[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	34.5[illegible]	34.64	[illegible]	[illegible]	27.3[illegible]	27.3[illegible]	27.37	.[illegible]141	[illegible]
1100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.67	34.66	[illegible]	27.4[illegible]	27.4[illegible]	27.4	[illegible]	[illegible]

AREA FIVE - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.97	17.76	14.68	1.3741	33.91	33.56	33.16	.1632	25.2[illegible]	24.[illegible]	[illegible]	.27[illegible]	27
10	19.1[illegible]	17.31	13.7[illegible]	1.6[illegible]	33.9[illegible]	[illegible]	33.16	.1742	25.4[illegible]	24.[illegible]76	24.79	[illegible]	27
20	18.91	15.9[illegible]	11.6[illegible]	[illegible]	33.92	[illegible]	[illegible]	.1569	25.6[illegible]	24.657	[illegible]	.[illegible]171	26
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AREA FIVE - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	16.05	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0422	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	34.4[illegible]	34.49	34.4[illegible]	[illegible]	27.3[illegible]	27.3[illegible]	27.36	[illegible]	1

AREA FIVE - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	16.26	[illegible]	1.4662	[illegible]	[illegible]	[illegible]	.1247	25.56	24.83[illegible]	[illegible]	.3369	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.4[illegible]	34.45	34.45	[illegible]	27.34	27.34[illegible]	27.34	.0000	1

Figure C.5.

AREA SIX - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	16.71	[illegible]	[illegible]	33.71	33.42	32.28	.3737	25.38	24.823	23.85	.3556	41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.70	33.42	[illegible]	[illegible]	25.43	24.883	24.16	.2221	41
[illegible]	16.77	[illegible]	[illegible]	[illegible]	33.70	33.42	33.16	.1559	25.51	24.915	24.17	.2427	41
[illegible]	[illegible]	15.59	[illegible]	[illegible]	33.70	33.43	33.17	.1630	25.62	25.048	24.45	.2842	41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.71	33.45	33.17	.1168	25.83	25.326	24.80	.2676	40
[illegible]	[illegible]	[illegible]	[illegible]	.9905	33.87	33.56	33.20	.1469	26.10	25.623	[illegible]	.2331	36
[illegible]	[illegible]	10.52	[illegible]	.7263	34.03	33.70	33.42	.1207	26.23	25.880	25.41	.1623	35
[illegible]	11.25	[illegible]	[illegible]	[illegible]	34.04	33.82	33.57	.1307	26.34	26.074	25.63	.1455	34
[illegible]	10.67	9.46	8.67	[illegible]	34.09	33.93	33.76	.0926	26.43	26.215	[illegible]	.1156	34
[illegible]	[illegible]	[illegible]	[illegible]	.2774	34.21	34.12	33.98	.0664	26.55	26.444	26.23	.0671	33
[illegible]	[illegible]	[illegible]	[illegible]	.3119	34.27	34.19	34.09	.0460	26.66	26.575	26.50	.0452	27
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.30	34.23	34.14	.0460	26.75	26.677	26.61	.0419	25
[illegible]	7.59	7.17	6.76	.1913	34.36	34.25	34.17	.0392	26.92	26.821	26.75	.0454	22
[illegible]	[illegible]	[illegible]	[illegible]	.1761	34.30	34.27	34.16	.0341	27.00	26.917	26.87	.0346	13
[illegible]	5.82	5.69	[illegible]	.1261	34.35	34.23	34.20	.0216	27.11	27.080	27.06	.0245	4

AREA SIX - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	21.91	[illegible]	[illegible]	[illegible]	33.85	33.56	[illegible]	.1672	24.48	23.781	23.23	.5467	42
[illegible]	[illegible]	[illegible]	13.44	[illegible]	33.87	[illegible]	33.21	.1402	25.18	24.171	[illegible]	.5263	42
[illegible]	[illegible]	[illegible]	11.74	1.7866	33.76	33.48	33.15	.1412	25.59	24.808	23.91	.4191	38
[illegible]	[illegible]	[illegible]	[illegible]	1.5519	33.80	33.45	33.10	.1613	25.91	25.170	24.34	.3769	38
[illegible]	[illegible]	[illegible]	[illegible]	1.2776	33.83	33.47	33.17	.1496	26.01	25.515	24.63	.3006	37
[illegible]	[illegible]	10.47	[illegible]	.9097	33.90	[illegible]	[illegible]	.1576	26.19	25.792	24.98	.2472	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.71	33.37	.1398	26.28	25.966	[illegible]	.2036	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1170	26.37	26.104	25.62	.1602	31
[illegible]	[illegible]	9.47	[illegible]	.6612	34.13	33.92	33.65	.1042	26.43	26.216	25.93	.1221	30
[illegible]	[illegible]	[illegible]	[illegible]	.4771	34.27	34.07	33.91	.0752	26.52	26.389	26.16	.0826	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.30	34.15	33.98	.0766	26.63	26.514	26.29	.0726	27
[illegible]	[illegible]	[illegible]	[illegible]	.4471	34.34	34.22	34.12	.0701	26.73	26.612	26.44	.0640	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.35	34.25	34.20	.0435	26.86	26.769	26.65	.0507	16
[illegible]	[illegible]	[illegible]	[illegible]	.1399	34.31	[illegible]	[illegible]	.0095	26.98	26.933	26.90	.0315	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.26	34.26	34.26	.0000	26.90	26.900	26.90	.0000	1

WRGT KEEP.SORT

AREA SIX - SPRING

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	16.26	[illegible]	[illegible]	33.76	[illegible]	[illegible]	[illegible]	25.19	24.392	23.25	.4595	62
[illegible]	[illegible]	15.74	[illegible]	1.6548	[illegible]	33.47	33.17	[illegible]	[illegible]	24.645	[illegible]	.3813	62
[illegible]	[illegible]	13.78	[illegible]	[illegible]	[illegible]	33.47	33.19	.3792	25.57	25.060	24.27	.2816	61
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.79	[illegible]	[illegible]	.1167	25.88	25.377	[illegible]	.2591	60
[illegible]	[illegible]	[illegible]	[illegible]	.7974	33.81	33.60	33.34	[illegible]	26.04	25.731	25.26	.1913	56
[illegible]	[illegible]	[illegible]	[illegible]	.6457	[illegible]	[illegible]	[illegible]	[illegible]	26.19	25.997	25.69	.1325	51
[illegible]	[illegible]	[illegible]	[illegible]	.2272	[illegible]	[illegible]	[illegible]	[illegible]	26.37	26.176	25.96	[illegible]	50
[illegible]	[illegible]	[illegible]	[illegible]	.2071	[illegible]	33.98	[illegible]	[illegible]	26.46	26.293	26.10	[illegible]	48
[illegible]	9.73	[illegible]	[illegible]	[illegible]	34.23	34.06	[illegible]	[illegible]	26.53	26.387	26.19	.0719	48
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.31	34.17	[illegible]	.0598	26.65	26.524	26.41	.0492	47
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.34	[illegible]	34.11	[illegible]	26.71	26.616	[illegible]	[illegible]	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.36	[illegible]	[illegible]	.0436	26.80	26.702	[illegible]	.0384	41
[illegible]	[illegible]	[illegible]	[illegible]	.2296	[illegible]	[illegible]	34.17	[illegible]	26.96	[illegible]	[illegible]	.0516	33
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.40	[illegible]	[illegible]	.0417	27.03	[illegible]	26.87	[illegible]	23
[illegible]	[illegible]	[illegible]	[illegible]	.2467	34.37	34.34	[illegible]	.0151	27.16	27.071	27.00	.0532	8

AREA SIX - FALL

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.79	[illegible]	33.16	.1673	25.36	24.226	[illegible]	[illegible]	41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.07	[illegible]	[illegible]	[illegible]	41
[illegible]	[illegible]	[illegible]	[illegible]	1.6216	33.78	33.45	33.16	.1673	25.23	24.573	23.59	.3925	42
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.42	33.17	[illegible]	25.43	[illegible]	[illegible]	[illegible]	40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.67	33.46	33.11	.1672	25.77	25.201	[illegible]	.3214	40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.02	25.524	24.71	[illegible]	36
[illegible]	12.57	12.26	[illegible]	[illegible]	33.82	33.67	[illegible]	.1162	26.23	25.736	24.81	.2656	32
[illegible]	[illegible]	11.44	[illegible]	[illegible]	[illegible]	[illegible]	33.44	[illegible]	26.31	[illegible]	[illegible]	[illegible]	33
[illegible]	[illegible]	9.59	6.79	.6712	34.08	[illegible]	[illegible]	.1126	26.42	26.095	[illegible]	.1951	34
[illegible]	[illegible]	9.11	[illegible]	.4327	34.27	[illegible]	33.94	[illegible]	26.58	26.347	26.01	.1173	32
[illegible]	9.33	8.79	[illegible]	.3852	34.31	34.17	[illegible]	.0618	26.73	26.516	[illegible]	.0722	29
[illegible]	9.07	[illegible]	7.44	.3472	34.37	34.33	[illegible]	[illegible]	26.76	26.673	26.48	[illegible]	25
[illegible]	[illegible]	7.32	[illegible]	.3464	34.37	34.27	34.21	.0362	26.91	26.812	26.62	.0235	17
[illegible]	[illegible]	6.66	6.17	[illegible]	34.34	34.31	[illegible]	.0257	27.03	26.970	26.92	.0415	6

WRGT KEEP.SORT

Figure C.6.

COPY AVAILABLE TO DDC DOES NOT PERMIT FULLY LEGIBLE PRODUCTION

AREA SEVEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	[illegible]	[illegible]	[illegible]	33.71	33.48	33.10	.1372	25.46	[illegible]	24.11	.2296	47
10	16.17	14.44	[illegible]	1.0796	33.71	33.48	33.11	.1424	25.57	24.971	24.18	.2286	47
20	16.42	14.22	11.27	1.1032	33.71	33.46	33.16	.1372	25.75	24.979	24.25	.2454	47
30	16.19	[illegible]	10.59	1.2297	33.79	33.48	33.11	.1407	[illegible]	25.046	24.39	.2611	47
50	[illegible]	12.76	9.27	1.4276	33.82	33.49	33.18	.1276	26.07	[illegible]	24.71	[illegible]	47
75	[illegible]	[illegible]	8.54	.9964	33.84	33.56	33.19	.1271	26.36	25.636	25.34	.2297	47
100	11.27	[illegible]	9.12	.7102	[illegible]	33.69	33.41	.1126	26.36	25.876	25.64	.1674	46
125	[illegible]	9.83	[illegible]	[illegible]	34.07	33.81	33.54	.0991	26.50	26.089	25.69	.1559	46
150	10.52	9.42	8.47	[illegible]	34.18	[illegible]	33.67	.0831	26.46	26.221	25.82	.1273	45
200	9.08	8.87	8.14	.4217	34.19	34.08	33.93	.0547	26.59	26.415	26.19	.0811	44
250	9.29	[illegible]	7.71	.2242	34.24	34.16	34.05	.0464	26.68	26.580	26.46	.0508	42
300	8.42	7.89	[illegible]	[illegible]	34.27	34.20	34.08	.0460	26.76	26.682	26.60	.0447	41
400	[illegible]	7.24	6.82	.2327	34.32	34.26	34.18	.0337	26.93	26.866	26.77	.0331	41
500	6.77	6.11	6.37	.1604	34.35	[illegible]	34.15	.0349	27.05	[illegible]	26.89	.0385	40
600	5.67	5.67	5.24	.0742	34.45	34.34	[illegible]	.0526	27.20	27.091	27.00	.0436	19
700	5.31	5.16	[illegible]	.1019	34.47	34.39	34.34	.0288	27.23	27.186	27.14	.0277	13
800	4.85	4.72	[illegible]	[illegible]	34.44	34.41	34.35	.0343	27.29	27.256	27.16	.0427	13
900	4.53	4.19	[illegible]	[illegible]	34.48	[illegible]	[illegible]	.0412	27.35	27.305	27.16	.0345	11
1000	4.25	4.22	[illegible]	[illegible]	34.48	34.42	34.35	.0921	27.36	27.336	27.18	.0720	5
1100	4.17	4.13	[illegible]	.0379	34.48	34.46	34.43	.0289	27.36	27.363	27.33	.0289	3
1200	[illegible]	[illegible]	[illegible]	.0000	34.48	34.46	34.48	.0000	27.39	27.390	27.39	.0000	1

AREA SEVEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	19.72	[illegible]	1.2565	[illegible]	[illegible]	33.36	.1562	[illegible]	23.734	[illegible]	.3302	40
10	21.31	[illegible]	16.44	1.4853	33.64	[illegible]	33.16	[illegible]	[illegible]	23.691	[illegible]	.3774	40
20	[illegible]	16.59	13.91	1.6571	33.77	[illegible]	[illegible]	.1337	25.25	24.476	[illegible]	.4196	38
30	[illegible]	14.51	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1340	25.73	[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]	12.29	9.92	1.1467	33.78	33.62	33.16	.1518	26.00	25.407	24.75	.2960	38
75	[illegible]	10.44	[illegible]	[illegible]	33.84	33.61	33.28	.1606	26.25	25.774	[illegible]	.2389	38
100	[illegible]	9.42	9.11	.4571	34.06	33.70	[illegible]	.1632	26.33	26.027	25.71	.1692	38
125	[illegible]	9.44	[illegible]	.2424	34.09	33.85	33.62	.1196	26.40	26.184	[illegible]	.1269	38
150	[illegible]	9.16	[illegible]	.2167	34.23	33.98	33.76	.1044	26.48	26.334	26.13	.0955	38
200	9.26	8.74	8.13	.2071	34.28	34.12	33.98	[illegible]	26.58	26.486	26.28	.0679	38
250	[illegible]	[illegible]	[illegible]	[illegible]	34.27	34.18	[illegible]	.0490	26.66	26.602	[illegible]	[illegible]	37
300	[illegible]	7.96	[illegible]	.1371	34.38	[illegible]	34.13	.0539	26.92	26.686	[illegible]	.0527	37
400	[illegible]	7.17	[illegible]	.2517	[illegible]	34.27	34.12	.0411	26.96	[illegible]	26.73	.0626	36
500	6.71	6.44	[illegible]	[illegible]	34.37	[illegible]	34.25	.0265	27.04	26.962	26.91	.0215	[illegible]
600	[illegible]	5.55	[illegible]	.1141	34.39	34.33	[illegible]	.0379	27.12	27.057	27.03	.0339	[illegible]
700	[illegible]	[illegible]	5.16	[illegible]	34.42	34.36	[illegible]	.0262	27.23	27.153	[illegible]	.0377	7
800	[illegible]	[illegible]	4.73	.1097	34.42	34.36	34.32	.0297	27.26	27.215	27.16	.0373	6
900	[illegible]	4.56	[illegible]	.0927	34.44	34.39	34.35	[illegible]	27.28	27.260	[illegible]	[illegible]	4
1000	[illegible]	[illegible]	[illegible]	.0161	34.42	34.46	[illegible]	.0495	27.36	27.335	27.31	[illegible]	2

AREA SEVEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	16.36	[illegible]	1.6552	[illegible]	[illegible]	33.37	.1462	[illegible]	24.576	23.73	.3792	52
10	[illegible]	15.92	[illegible]	1.5464	33.73	33.51	33.17	.1441	[illegible]	24.637	[illegible]	[illegible]	52
20	[illegible]	14.72	12.17	1.4147	33.73	33.51	33.17	.1297	[illegible]	24.858	[illegible]	[illegible]	51
30	[illegible]	13.41	[illegible]	1.2875	33.75	33.51	[illegible]	.1105	[illegible]	25.199	24.37	[illegible]	51
50	[illegible]	11.42	[illegible]	[illegible]	33.63	33.56	[illegible]	.1027	26.03	25.591	[illegible]	.2239	51
75	[illegible]	[illegible]	[illegible]	[illegible]	33.90	33.69	[illegible]	.0919	26.21	25.997	[illegible]	.1707	51
100	[illegible]	9.69	[illegible]	.4402	[illegible]	33.83	[illegible]	.0925	26.33	[illegible]	[illegible]	.1404	51
125	[illegible]	[illegible]	[illegible]	[illegible]	34.09	[illegible]	33.70	.0868	26.41	[illegible]	[illegible]	.1047	51
150	[illegible]	[illegible]	[illegible]	.2267	34.23	34.04	33.80	.0796	26.55	26.380	[illegible]	[illegible]	51
200	[illegible]	[illegible]	[illegible]	.3444	[illegible]	34.15	[illegible]	.0537	26.64	26.537	26.41	[illegible]	51
250	[illegible]	8.10	[illegible]	[illegible]	34.20	34.23	[illegible]	.0507	26.73	26.639	26.51	.0506	50
300	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.23	[illegible]	.0496	26.82	26.724	[illegible]	.0482	49
400	7.82	7.27	6.84	[illegible]	34.32	34.27	34.12	.0362	26.92	26.876	[illegible]	.0433	47
500	[illegible]	6.17	[illegible]	.1734	[illegible]	[illegible]	34.14	.0337	[illegible]	[illegible]	[illegible]	.0397	46
600	[illegible]	5.61	[illegible]	.1279	34.38	34.34	34.29	.0229	27.14	[illegible]	[illegible]	.0243	18
700	[illegible]	[illegible]	[illegible]	.1117	[illegible]	34.35	[illegible]	.0264	27.21	[illegible]	27.14	.0265	7
800	[illegible]	[illegible]	[illegible]	.0556	34.42	34.39	34.36	.0245	27.28	27.241	[illegible]	.0273	7
900	[illegible]	[illegible]	[illegible]	.0559	34.46	34.41	34.35	.0361	27.33	27.293	27.25	.0266	6
1000	[illegible]	[illegible]	[illegible]	[illegible]	34.44	34.44	34.44	.0000	27.36	27.360	27.36	[illegible]	1
1100	[illegible]	[illegible]	4.17	[illegible]	34.46	34.46	34.46	.0000	27.36	27.360	27.36	.0000	1

AREA SEVEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.52	[illegible]	.1690	25.03	24.153	[illegible]	.4079	35
10	[illegible]	17.87	[illegible]	[illegible]	33.77	33.55	[illegible]	.1518	[illegible]	24.197	[illegible]	[illegible]	35
20	[illegible]	16.54	[illegible]	1.2574	33.72	33.47	[illegible]	.1275	25.07	24.466	23.67	.3358	35
30	[illegible]	[illegible]	[illegible]	1.6027	[illegible]	33.44	33.32	.1338	[illegible]	24.737	[illegible]	[illegible]	35
50	14.67	[illegible]	[illegible]	1.3961	33.61	33.41	[illegible]	.1336	25.64	25.245	24.81	.2673	35
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1767	25.91	25.399	[illegible]	.1974	34
100	[illegible]	10.29	[illegible]	.6201	33.70	33.67	33.42	.1531	26.17	25.671	[illegible]	.1527	34
125	[illegible]	[illegible]	[illegible]	[illegible]	34.07	33.91	33.64	[illegible]	26.33	[illegible]	[illegible]	.1297	34
150	[illegible]	9.45	[illegible]	.4226	34.13	33.93	33.72	[illegible]	26.48	26.215	26.01	.1087	34
200	9.39	[illegible]	7.97	.3527	34.25	34.07	33.95	.0603	26.61	26.424	26.27	.0735	34
250	9.13	8.47	7.67	.3282	34.28	34.17	[illegible]	.0512	26.68	26.565	26.43	.0501	33
300	[illegible]	[illegible]	7.19	.2901	34.35	34.21	[illegible]	.0449	26.77	[illegible]	[illegible]	.0498	33
400	7.75	7.23	[illegible]	.2012	34.32	34.27	[illegible]	.0319	26.92	26.829	26.75	.0376	32
500	6.75	6.46	[illegible]	.1312	34.40	34.31	34.27	.0311	27.04	26.972	26.91	.0319	31
600	5.95	5.77	5.60	[illegible]	34.39	34.35	34.31	.0229	27.13	27.086	27.03	.0267	8
700	[illegible]	5.37	[illegible]	.0964	34.40	[illegible]	34.37	.0351	27.25	27.213	27.16	.0351	3
800	4.81	4.73	4.67	.0727	34.50	34.45	34.40	.0502	27.31	27.283	27.25	.0306	3
900	4.61	[illegible]	[illegible]	[illegible]	34.44	34.43	34.41	.0287	27.33	27.310	27.29	.0283	2

Figure C.7.

AREA EIGHT - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)		TEMPERATURE (C) MAX	MEAN	MIN	ST DEV		SALINITY (PPT) MAX	MEAN	MIN	ST DEV		SIGMA-T MAX	MEAN	MIN	ST DEV	NUM	
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	16	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	16	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	18	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	18	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	.0675	17	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	17	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	17	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	17	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	17	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	7	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	27.29	27.276	[illegible]	[illegible]	7	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	6	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	6	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	6	**
[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	27.385	[illegible]	[illegible]	2	**

AREA EIGHT - SUMMER

[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**

AREA EIGHT - SPRING

[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**

AREA EIGHT - FALL

[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**

Figure C.8.

AREA NINE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	12.46	[illegible]	[illegible]	[illegible]	33.62	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25.96	.4744	[illegible]
[illegible]	[illegible]	[illegible]	14.73	[illegible]	33.54	[illegible]	[illegible]	.2517	26.94	[illegible]	[illegible]	.2897	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.65	33.65	[illegible]	[illegible]	26.96	26.723	24.37	.7163	[illegible]
[illegible]	14.75	[illegible]	[illegible]	[illegible]	33.57	33.45	[illegible]	.1767	[illegible]	24.887	24.71	.1676	[illegible]
[illegible]	[illegible]	10.50	[illegible]	[illegible]	33.51	33.51	[illegible]	.0071	[illegible]	[illegible]	[illegible]	.1202	2
75	11.64	[illegible]	[illegible]	[illegible]	33.59	[illegible]	[illegible]	[illegible]	25.71	[illegible]	[illegible]	.1275	2
[illegible]	[illegible]	10.29	[illegible]	[illegible]	33.85	33.74	33.67	.0778	26.03	25.935	25.86	.1244	2
[illegible]	[illegible]	9.96	9.77	[illegible]	[illegible]	[illegible]	[illegible]	.0495	26.14	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	9.23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0263	26.25	[illegible]	26.18	.0676	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0293	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.19	[illegible]	34.17	.0141	[illegible]	[illegible]	26.57	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.21	[illegible]	[illegible]	[illegible]	26.695	26.69	.0071	2
[illegible]	[illegible]	7.16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0141	26.87	26.835	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.01	[illegible]	26.93	.0566	2

AREA NINE - SUMMER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.57	23.525	[illegible]	.0636	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.77	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	14.14	[illegible]	[illegible]	[illegible]	33.43	[illegible]	[illegible]	24.95	24.915	[illegible]	.0719	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.54	33.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.56	[illegible]	33.56	[illegible]	[illegible]	[illegible]	[illegible]	.0000	1
[illegible]	10.17	[illegible]	[illegible]	[illegible]	33.69	33.69	33.69	[illegible]	[illegible]	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	9.29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.12	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.26	[illegible]	26.26	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.35	[illegible]	26.35	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.43	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	8.95	[illegible]	[illegible]	34.15	34.15	34.15	[illegible]	[illegible]	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.51	[illegible]	[illegible]	.0000	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.27	34.27	[illegible]	26.71	[illegible]	26.71	.0000	1
[illegible]	[illegible]	6.81	[illegible]	[illegible]	34.27	[illegible]	34.27	[illegible]	[illegible]	[illegible]	[illegible]	.0000	1

AREA NINE - SPRING

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	17.12	[illegible]	[illegible]	33.72	33.42	[illegible]	[illegible]	26.83	[illegible]	[illegible]	[illegible]	13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.72	33.46	33.19	[illegible]	25.85	25.176	[illegible]	[illegible]	11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
[illegible]	[illegible]	11.21	[illegible]	[illegible]	33.96	[illegible]	[illegible]	.1411	26.13	[illegible]	[illegible]	[illegible]	9
75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.0926	[illegible]	[illegible]	[illegible]	.1167	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26.32	26.217	[illegible]	.0275	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.96	[illegible]	26.42	[illegible]	26.21	[illegible]	9
[illegible]	9.43	[illegible]	[illegible]	[illegible]	34.16	[illegible]	[illegible]	[illegible]	26.50	26.363	[illegible]	[illegible]	9
[illegible]	[illegible]	[illegible]	[illegible]	.1727	[illegible]	[illegible]	34.11	[illegible]	26.59	[illegible]	26.46	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	[illegible]	26.66	26.611	[illegible]	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.26	[illegible]	.0216	26.75	[illegible]	[illegible]	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.32	34.27	[illegible]	[illegible]	[illegible]	26.626	[illegible]	[illegible]	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27.00	[illegible]	[illegible]	[illegible]	6

AREA NINE - FALL

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24.41	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24.71	[illegible]	24.71	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.77	33.77	33.77	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33.92	[illegible]	[illegible]	[illegible]	26.29	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.11	34.11	34.11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.17	34.17	34.17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1

Figure C.9.

AREA TEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	21.07	16.04	12.33	1.4368	34.59	33.63	33.09	.2687	25.29	24.694	24.05	.1866	447
10	21.08	15.99	12.37	1.4266	34.60	33.63	33.12	.2658	25.29	24.701	24.02	.1653	447
20	21.07	15.94	12.57	1.4526	34.59	33.63	33.03	.2684	25.33	24.716	24.03	.1887	433
30	21.06	15.86	11.93	1.5072	34.59	33.63	33.11	.2705	25.46	24.757	24.02	.1995	433
50	21.03	15.43	10.52	1.7376	34.60	33.62	33.04	.2707	25.75	24.815	24.02	.2394	432
75	19.53	14.00	9.44	2.0375	34.68	33.57	33.05	.2463	25.96	25.077	24.33	.3140	427
100	17.49	12.20	8.98	1.3892	34.57	33.58	33.07	.1937	26.18	25.456	24.57	.2955	425
125	15.33	11.00	8.89	1.0917	34.53	33.72	33.16	.1843	26.28	25.788	24.93	.2256	424
150	13.92	10.24	8.50	.8370	34.55	33.87	33.23	.1867	26.41	26.041	25.33	.1760	422
200	12.01	9.46	7.78	.7653	34.65	34.11	33.34	.1686	26.58	26.359	25.83	.0991	418
250	11.27	8.93	7.33	.7567	34.67	34.23	33.94	.1438	26.69	26.543	26.21	.0606	410
300	10.44	8.39	6.70	.6970	34.62	34.28	34.02	.1250	26.82	26.664	26.37	.0518	402
400	8.97	7.37	6.17	.5445	34.55	34.32	34.04	.0892	27.00	26.844	26.61	.0432	391
500	7.78	6.32	5.58	.3901	34.56	34.35	34.05	.0658	27.11	26.987	26.75	.0400	376
600	6.84	5.79	5.07	.2658	34.68	34.37	34.33	.0535	27.20	27.099	26.94	.0366	221
700	5.59	5.23	4.75	.1721	34.50	34.39	34.21	.0462	27.29	27.189	27.06	.0381	135
800	5.04	4.77	4.47	.1335	34.52	34.43	34.28	.0430	27.35	27.265	27.15	.0349	126
900	4.60	4.38	4.17	.1066	34.55	34.46	34.32	.0435	27.41	27.330	27.23	.0329	122
1000	4.23	4.06	3.85	.0896	34.58	34.48	34.31	.0409	27.48	27.385	27.25	.0326	109
1100	3.93	3.75	3.58	.0749	34.59	34.50	34.31	.0397	27.51	27.433	27.27	.0318	95
1200	3.66	3.53	3.39	.0664	34.58	34.52	34.30	.0449	27.53	27.476	27.29	.0389	36
1300	3.34	3.27	3.16	.0585	34.55	34.54	34.53	.0088	27.53	27.513	27.50	.0106	10
1400	3.09	3.04	2.96	.0538	34.57	34.55	34.55	.0076	27.56	27.547	27.54	.0089	8
1500	2.90	2.86	2.75	.0106	34.58	34.57	34.56	.0090	27.59	27.577	27.57	.0095	7
1750	2.46	2.43	2.32	.0432	34.61	34.60	34.59	.0079	27.65	27.643	27.63	.0076	7
2000	2.15	2.10	2.06	.0336	34.63	34.62	34.61	.0069	27.69	27.681	27.67	.0069	7
2500	1.81	1.79	1.76	.0192	34.65	34.65	34.65	.0000	27.73	27.730	27.73	.0000	3
3000	1.63	1.62	1.61	.0100	34.66	34.66	34.66	.0000	27.75	27.750	27.75	.0000	3

AREA TEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	25.33	19.48	13.82	1.8686	34.44	33.63	33.17	.1846	25.36	23.841	22.58	.3917	386
10	25.33	19.22	13.34	1.8896	34.46	33.63	33.13	.1869	25.26	23.932	22.60	.3948	385
20	23.23	18.32	12.62	1.8475	34.30	33.59	33.16	.1901	25.40	24.112	22.98	.3755	370
30	22.46	17.33	11.32	2.0072	34.25	33.55	33.12	.1931	25.73	24.367	23.31	.3998	369
50	19.93	14.91	9.73	2.1240	34.20	33.50	32.93	.1937	26.04	24.831	23.96	.4094	368
75	18.42	13.03	8.91	2.0078	34.13	33.52	32.98	.1885	26.25	25.240	24.42	.4073	366
100	16.06	11.60	8.71	1.6313	34.30	33.62	33.16	.1937	26.39	25.599	24.75	.3358	364
125	14.67	10.62	8.46	1.0891	34.58	33.77	33.28	.2021	26.50	25.900	25.23	.2686	364
150	12.34	10.01	8.31	.8415	34.71	33.93	33.48	.2015	26.56	26.127	25.60	.1945	363
200	12.01	9.41	7.68	.8334	34.71	34.16	33.83	.1707	26.71	26.406	26.10	.1036	360
250	11.15	8.93	7.32	.8616	34.71	34.26	33.95	.1340	26.80	26.563	26.41	.0700	354
300	10.72	8.45	6.83	.8161	34.71	34.31	34.01	.1166	26.86	26.676	26.50	.0636	352
400	9.87	7.43	6.20	.6690	34.64	34.33	34.10	.0951	27.05	26.845	26.67	.0536	345
500	8.29	6.51	5.61	.4806	34.57	34.35	34.17	.0631	27.20	26.994	26.81	.0465	326
600	7.03	5.80	5.03	.3359	34.58	34.38	34.23	.0527	27.27	27.097	26.93	.0478	135
700	6.11	5.33	4.69	.2406	34.58	34.42	34.23	.0526	27.37	27.196	27.07	.0495	91
800	5.43	4.85	4.34	.1968	34.60	34.45	34.34	.0517	27.44	27.273	27.17	.0444	89
900	4.88	4.45	4.02	.1500	34.60	34.47	34.36	.0481	27.44	27.335	27.25	.0376	83
1000	4.42	4.11	3.71	.1325	34.63	34.50	34.36	.0475	27.50	27.392	27.28	.0340	81
1100	4.06	3.82	3.51	.1041	34.63	34.52	34.42	.0447	27.52	27.443	27.35	.0378	68
1200	3.78	3.59	3.37	.1031	34.69	34.55	34.48	.0447	27.59	27.489	27.41	.0372	34
1300	3.56	3.34	3.19	.1350	34.58	34.55	34.50	.0282	27.54	27.514	27.46	.0378	7
1400	3.20	3.13	3.01	.0714	34.60	34.58	34.55	.0222	27.57	27.555	27.51	.0191	4
1500	3.01	2.92	2.82	.0785	34.61	34.58	34.55	.0275	27.60	27.580	27.55	.0243	4
1750	2.51	2.46	2.37	.0640	34.63	34.61	34.58	.0231	27.66	27.637	27.62	.0206	4
2000	2.19	2.16	2.12	.0379	34.63	34.61	34.60	.0173	27.68	27.667	27.66	.0115	3
2500	1.84	1.83	1.81	.0071	34.64	34.63	34.63	.0071	27.71	27.710	27.71	.0000	2
3000	1.75	1.75	1.75	.0000	34.63	34.63	34.63	.0000	27.71	27.710	27.71	.0000	1

AREA TEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.62	16.29	12.45	1.0866	34.54	33.55	33.07	.2033	25.46	24.580	23.92	.1972	609
10	19.67	16.20	12.16	1.0842	34.51	33.54	33.07	.2012	25.54	24.594	24.05	.1960	609
20	19.66	16.03	11.40	1.2167	34.54	33.55	33.07	.2024	25.62	24.642	23.97	.2205	593
30	19.63	15.69	10.71	1.4069	34.56	33.54	33.05	.2066	25.78	24.704	24.04	.2374	592
50	19.15	14.66	9.67	1.8696	34.48	33.52	33.01	.2156	26.15	24.901	24.26	.3348	591
75	18.80	13.18	9.26	2.0698	34.39	33.51	33.03	.2047	26.31	25.203	24.37	.3901	588
100	17.57	11.72	8.92	1.6521	34.26	33.58	33.08	.1958	26.42	25.545	24.60	.3617	587
125	14.65	10.63	8.55	1.1217	34.57	33.73	33.18	.2040	26.46	25.862	24.88	.2750	585
150	13.12	9.97	8.17	.8375	34.53	33.89	33.37	.1909	26.53	26.104	25.43	.2027	580
200	12.18	9.31	7.86	.7806	34.67	34.13	33.70	.1607	26.64	26.403	25.89	.1103	569
250	11.29	8.80	7.25	.7861	34.66	34.24	33.94	.1450	26.75	26.569	26.23	.0725	557
300	10.38	8.29	6.63	.7361	34.67	34.29	34.00	.1266	26.86	26.686	26.48	.0593	549
400	9.09	7.30	6.02	.5637	34.62	34.33	34.04	.0893	27.00	26.861	26.68	.0458	537
500	7.86	6.46	5.63	.3925	34.55	34.35	34.12	.0641	27.13	27.002	26.83	.0411	512
600	6.47	5.81	5.18	.2678	34.63	34.39	34.19	.0558	27.29	27.111	26.96	.0409	281
700	5.89	5.23	4.73	.2114	34.63	34.42	34.28	.0488	27.36	27.205	27.04	.0371	159
800	5.10	4.78	4.28	.1548	34.62	34.44	34.33	.0434	27.40	27.279	27.20	.0297	149
900	4.65	4.39	3.94	.1215	34.58	34.47	34.36	.0398	27.41	27.339	27.25	.0290	140
1000	4.27	4.05	3.71	.1011	34.57	34.49	34.39	.0367	27.48	27.390	27.32	.0284	133
1100	3.95	3.77	3.60	.0806	34.59	34.50	34.42	.0348	27.51	27.433	27.36	.0295	98
1200	3.66	3.53	3.38	.0749	34.63	34.52	34.44	.0374	27.55	27.475	27.40	.0314	47
1300	3.41	3.31	3.15	.0727	34.59	34.55	34.51	.0194	27.56	27.517	27.48	.0173	19
1400	3.17	3.09	2.98	.0860	34.59	34.56	34.55	.0124	27.56	27.547	27.53	.0095	13
1500	2.97	2.89	2.78	.0620	34.61	34.57	34.55	.0165	27.60	27.574	27.55	.0119	13
1750	2.58	2.47	2.34	.0671	34.64	34.60	34.57	.0155	27.66	27.632	27.60	.0141	13
2000	2.23	2.14	2.03	.0619	34.67	34.62	34.59	.0116	27.69	27.675	27.65	.0106	11
2500	1.83	1.80	1.78	.0207	34.65	34.64	34.63	.0183	27.75	27.738	27.69	.0183	6
3000	1.66	1.64	1.63	.0192	34.67	34.66	34.66	.0055	27.75	27.750	27.75	.0000	5

AREA TEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	24.25	19.08	14.67	2.0395	34.52	33.65	33.16	.2334	25.00	23.968	22.98	.4215	344
10	24.25	19.02	14.67	2.0516	34.52	33.65	33.20	.2349	25.00	23.981	23.01	.4217	344
20	23.82	18.73	13.28	2.0842	34.44	33.66	33.15	.2316	25.03	24.065	22.96	.4273	328
30	23.39	18.05	12.26	2.2621	34.43	33.60	33.12	.2336	25.32	24.175	23.23	.4466	328
50	21.69	15.31	9.71	2.0997	34.20	33.49	33.06	.1973	26.05	24.736	23.66	.4039	327
75	17.83	13.00	9.28	1.7093	34.07	33.52	33.09	.1834	26.15	25.252	24.48	.3330	325
100	16.16	11.55	8.79	1.3609	34.17	33.63	33.07	.1953	26.34	25.617	24.71	.2871	324
125	13.89	10.61	8.61	.9673	34.35	33.77	33.19	.1945	26.41	25.901	25.19	.2206	321
150	12.61	10.04	8.25	.8069	34.50	33.93	33.48	.1809	26.53	26.121	25.59	.1641	320
200	12.41	9.40	7.47	.7912	34.66	34.15	33.82	.1608	26.66	26.402	26.10	.0956	319
250	11.50	8.90	7.20	.7862	34.69	34.25	33.92	.1441	26.75	26.561	26.27	.0693	317
300	10.77	8.37	6.89	.7305	34.66	34.29	33.96	.1274	26.81	26.678	26.50	.0587	314
400	9.19	7.36	6.06	.5609	34.55	34.33	34.10	.0856	27.00	26.854	26.70	.0487	308
500	8.03	6.51	5.45	.3819	34.55	34.35	34.21	.0607	27.10	26.996	26.86	.0403	303
600	6.45	5.90	5.27	.2518	34.53	34.39	34.26	.0484	27.23	27.115	27.01	.0372	141
700	5.65	5.22	4.61	.1845	34.58	34.43	34.29	.0503	27.37	27.217	27.09	.0426	86
800	5.08	4.74	4.40	.1301	34.62	34.46	34.29	.0536	27.44	27.294	27.16	.0417	84
900	4.59	4.35	4.15	.1100	34.64	34.49	34.30	.0595	27.50	27.359	27.23	.0469	77
1000	4.20	4.01	3.77	.0996	34.67	34.51	34.34	.0589	27.56	27.412	27.28	.0495	68
1100	3.88	3.72	3.52	.0828	34.69	34.53	34.38	.0533	27.59	27.458	27.34	.0441	64
1200	3.59	3.48	3.32	.0768	34.62	34.56	34.48	.0326	27.56	27.492	27.44	.0290	19
1300	3.33	3.28	3.26	.0350	34.56	34.53	34.53	.0173	27.53	27.515	27.50	.0129	4
1400	3.12	3.10	3.09	.0212	34.57	34.55	34.54	.0212	27.55	27.540	27.53	.0141	2
1500	2.94	2.93	2.92	.0141	34.58	34.57	34.56	.0141	27.58	27.570	27.56	.0141	2
1750	2.50	2.48	2.46	.0283	34.62	34.61	34.61	.0071	27.64	27.640	27.64	.0000	2
2000	2.14	2.11	2.08	.0424	34.63	34.63	34.63	.0000	27.69	27.690	27.69	.0000	2
2500	1.80	1.80	1.80	.0000	34.66	34.66	34.66	.0000	27.73	27.730	27.73	.0000	1
3000	1.84	1.84	1.84	.0000	34.67	34.67	34.67	.0000	27.75	27.750	27.75	.0000	1

Figure C.10.

AREA ELEVEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	14.73	11.03	6.38	1.9977	33.59	31.16	19.32	3.7695	25.66	23.769	15.19	2.6690	124
10	14.71	11.18	7.30	1.6991	33.61	32.07	27.38	1.8788	25.66	24.461	21.39	1.2321	124
20	14.73	11.19	7.29	1.5997	33.60	32.25	28.68	1.5979	25.65	24.607	22.27	.9976	124
30	14.73	11.16	7.30	1.6499	33.59	32.33	29.24	1.4617	26.69	24.671	22.62	.9392	124
50	14.71	11.06	7.25	1.4301	33.61	32.43	29.54	1.2287	25.94	24.923	22.87	.8215	118
75	13.89	10.37	7.16	1.0894	33.77	32.82	29.77	1.1774	26.21	26.204	22.98	.8697	114
100	12.13	9.55	7.05	.6851	33.88	33.03	30.05	1.1777	26.36	25.989	23.16	.9180	113
125	10.97	9.12	7.86	.5517	33.96	33.46	30.23	.8708	26.42	25.908	23.26	.7163	102
150	10.20	8.73	7.50	.5194	34.01	33.68	30.49	.6945	26.50	26.144	23.92	.5798	99
200	9.00	8.03	6.83	.4193	34.09	33.96	33.63	.0460	26.63	26.473	24.17	.0746	92
250	8.56	7.45	6.30	.4339	34.17	34.02	33.88	.0539	26.73	26.600	26.42	.0612	92
300	8.02	6.91	5.96	.4126	34.23	34.05	33.93	.0555	26.82	26.703	26.53	.0542	92
400	6.96	6.06	5.48	.3584	34.25	34.11	33.94	.0596	26.98	26.862	26.73	.0411	88
500	6.26	5.46	4.93	.2958	34.28	34.18	34.00	.0534	27.08	26.990	26.83	.0407	85
600	5.65	4.95	4.59	.1984	34.44	34.24	34.03	.0575	27.25	27.095	26.92	.0484	49
700	4.85	4.56	4.21	.1523	34.43	34.30	34.10	.0509	27.28	27.193	27.02	.0435	42
800	4.43	4.23	4.00	.1260	34.44	34.36	34.14	.0480	27.33	27.269	27.09	.0378	42
900	4.16	3.95	3.70	.1216	34.46	34.40	34.13	.0533	27.39	27.332	27.11	.0427	39
1000	3.88	3.76	3.45	.1294	34.48	34.43	34.10	.0446	27.43	27.384	27.12	.0505	34
1100	3.69	3.46	3.25	.1194	34.50	34.45	34.07	.0785	27.46	27.423	27.12	.0413	28
1200	3.37	3.23	3.06	.1059	34.51	34.48	34.42	.0207	27.50	27.470	27.43	.0175	18
1300	3.13	3.07	2.71	.0814	34.52	34.50	34.49	.0103	27.52	27.507	27.49	.0121	6
1400	2.95	2.86	2.75	.0780	34.53	34.52	34.51	.0075	27.55	27.535	27.52	.0105	6
1500	2.78	2.71	2.58	.0764	34.56	34.54	34.53	.0064	27.58	27.566	27.55	.0114	5
1750	2.36	2.31	2.20	.0422	34.57	34.57	34.57	.0000	27.63	27.622	27.62	.0045	5
2000	2.07	2.03	1.96	.0462	34.60	34.60	34.59	.0045	27.68	27.670	27.66	.0071	5
2500	1.79	1.77	1.75	.0171	34.64	34.63	34.63	.0058	27.73	27.722	27.71	.0096	4
3000	1.65	1.62	1.62	.0116	34.66	34.65	34.66	.0058	27.75	27.747	27.74	.0054	3

AREA ELEVEN - SUMMER

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	23.85	14.62	9.89	2.0386	35.51	32.00	22.17	2.8396	25.85	23.747	15.97	2.3271	179
10	23.77	13.67	9.51	2.1124	35.50	32.57	28.48	1.3911	25.85	24.372	21.67	.9196	179
20	23.77	13.16	6.33	2.5387	35.49	32.61	29.25	1.3008	25.98	24.495	22.55	.8316	169
30	23.78	12.52	6.23	2.4651	35.49	32.64	29.38	1.2469	26.05	24.641	22.70	.6479	169
50	21.19	11.20	7.97	2.0594	35.19	32.89	29.53	1.0163	26.21	25.094	22.83	.7984	158
75	19.96	9.93	7.75	1.6049	35.14	33.02	29.88	1.0271	26.39	25.424	22.96	.8175	156
100	19.03	9.25	7.73	1.1962	35.03	33.25	29.80	.9839	26.50	25.717	23.04	.7942	149
125	18.69	8.79	7.64	1.0308	34.97	33.63	29.89	.7788	26.54	26.014	23.07	.6399	143
150	17.80	8.49	7.28	.9377	34.84	33.71	29.86	.6579	26.58	26.210	23.11	.5401	138
200	14.20	7.86	6.63	.6889	34.34	33.97	33.59	.0942	26.66	26.506	25.65	.1251	132
250	12.28	7.31	6.37	.6010	34.25	34.03	33.86	.0652	26.79	26.626	25.94	.0942	128
300	10.68	6.83	6.07	.5280	34.30	34.07	33.92	.0622	26.89	26.724	26.17	.0778	124
400	8.12	6.04	5.43	.3954	34.31	34.13	34.00	.0579	27.00	26.874	26.50	.0590	120
500	6.43	5.44	4.83	.2947	34.32	34.19	33.98	.0547	27.09	26.998	26.73	.0503	119
600	5.89	4.95	4.47	.2483	34.41	34.26	34.09	.0588	27.25	27.112	26.94	.0517	72
700	5.30	4.58	4.11	.2082	34.46	34.32	34.15	.0557	27.31	27.204	27.07	.0494	53
800	4.70	4.24	3.95	.1667	34.46	34.36	34.23	.0467	27.35	27.273	27.17	.0380	53
900	4.29	3.98	3.77	.1394	34.48	34.40	34.32	.0410	27.40	27.329	27.26	.0328	50
1000	4.01	3.73	3.53	.1205	34.52	34.43	34.36	.0384	27.45	27.383	27.32	.0300	43
1100	3.67	3.47	3.32	.1056	34.57	34.47	34.42	.0369	27.50	27.435	27.38	.0302	34
1200	3.40	3.28	3.10	.0911	34.57	34.49	34.42	.0472	27.53	27.472	27.42	.0362	12
1300	3.12	3.05	2.96	.0666	34.60	34.53	34.48	.0551	27.57	27.527	27.48	.0403	4
1400	2.97	2.87	2.78	.0787	34.62	34.56	34.51	.0486	27.60	27.562	27.53	.0299	4
1500	2.82	2.70	2.62	.0883	34.64	34.58	34.55	.0424	27.63	27.595	27.58	.0238	4
1750	2.38	2.31	2.25	.0591	34.65	34.61	34.58	.0311	27.68	27.660	27.64	.0183	4
2000	2.09	2.03	1.98	.0546	34.67	34.64	34.60	.0361	27.73	27.703	27.67	.0306	3
2500	1.76	1.74	1.76	.0000	34.73	34.71	34.69	.0283	27.79	27.775	27.76	.0212	2
3000	1.63	1.63	1.63	.0000	34.73	34.73	34.73	.0000	27.80	27.800	27.80	.0000	1

AREA ELEVEN - SPRING

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	16.65	12.05	9.95	1.3546	33.66	31.90	20.29	2.4465	26.00	24.069	15.20	2.2685	187
10	15.25	12.13	8.53	1.5234	33.65	32.47	24.88	1.4774	25.94	24.611	19.02	1.0022	185
20	14.95	11.85	8.31	1.6203	33.73	32.59	28.85	1.1907	25.96	24.752	22.38	.7699	180
30	14.67	11.56	8.23	1.6990	33.66	32.64	29.36	1.1241	26.02	24.845	22.78	.7422	177
50	14.17	10.96	8.25	1.4772	33.76	32.85	29.51	.9653	26.17	25.114	22.87	.7076	170
75	13.96	10.10	8.02	1.2961	33.88	32.98	29.70	.9767	26.32	25.373	22.98	.7582	169
100	13.10	9.35	7.95	.6550	33.96	33.19	29.86	.9657	26.44	25.664	23.06	.7708	167
125	11.38	8.86	7.56	.6293	34.04	33.55	29.96	.6307	26.57	26.023	23.12	.6292	158
150	10.06	8.49	7.35	.5303	34.08	33.72	30.00	.5640	26.63	26.208	23.13	.4787	157
200	9.33	7.89	6.79	.4306	34.21	33.96	33.67	.0859	26.73	26.497	26.18	.1048	152
250	8.51	7.30	6.49	.3906	34.26	34.02	33.86	.0679	26.79	26.623	26.37	.0719	147
300	7.72	6.80	6.00	.3568	34.31	34.06	33.92	.0689	26.88	26.726	26.55	.0575	145
400	6.79	6.07	5.29	.3208	34.33	34.13	33.96	.0460	27.01	26.879	26.77	.0466	141
500	6.00	5.49	4.94	.2602	34.39	34.20	34.05	.0580	27.12	27.006	26.90	.0390	132
600	5.32	4.96	4.46	.1973	34.44	34.26	34.13	.0568	27.23	27.112	27.01	.0396	89
700	4.85	4.56	4.00	.1682	34.46	34.32	34.17	.0518	27.32	27.206	27.09	.0386	88
800	4.46	4.25	3.85	.1369	34.48	34.37	34.25	.0448	27.37	27.281	27.19	.0313	67
900	4.15	3.95	3.70	.1071	34.48	34.41	34.32	.0385	27.40	27.342	27.27	.0279	66
1000	3.87	3.69	3.46	.0931	34.52	34.44	34.37	.0364	27.46	27.391	27.33	.0277	59
1100	3.62	3.45	3.21	.0874	34.54	34.46	34.40	.0345	27.50	27.433	27.38	.0269	52
1200	3.38	3.27	3.12	.0736	34.53	34.48	34.44	.0318	27.50	27.468	27.43	.0248	12
1300	3.11	3.10	3.09	.0096	34.54	34.52	34.51	.0141	27.53	27.512	27.50	.0126	4
1400	2.92	2.90	2.88	.0206	34.56	34.54	34.53	.0141	27.56	27.542	27.53	.0126	4
1500	2.74	2.70	2.67	.0367	34.56	34.55	34.54	.0082	27.58	27.572	27.57	.0050	4
1750	2.31	2.28	2.26	.0252	34.59	34.58	34.57	.0100	27.64	27.630	27.62	.0100	3
2000	2.07	2.05	2.03	.0206	34.61	34.60	34.58	.0173	27.68	27.667	27.65	.0153	3
2500	1.79	1.78	[illegible]	.0153	34.65	34.64	34.62	.0153	27.73	27.720	27.70	.0173	3
3000	1.64	1.63	1.61	.0153	34.66	34.65	34.66	.0058	27.75	27.750	27.75	.0000	3

AREA ELEVEN - FALL

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.95	13.60	7.51	2.7597	33.67	31.10	19.00	3.9565	25.61	23.230	14.73	2.6812	114
10	18.31	13.61	9.32	2.5386	33.67	32.35	28.60	1.4804	25.64	24.204	22.15	.7996	114
20	18.30	13.21	8.65	2.4723	33.67	32.45	29.91	1.3065	25.64	24.365	23.06	.6996	108
30	18.16	12.76	8.69	2.3221	33.69	32.50	30.08	1.2684	25.71	24.492	23.19	.7260	108
50	16.47	11.90	8.03	1.9476	33.78	32.77	30.25	1.0895	25.89	24.975	23.27	.7409	98
75	13.90	10.06	8.46	.8956	33.91	32.93	30.33	1.1075	26.20	25.336	23.32	.8681	97
100	12.26	9.42	7.76	.6951	33.97	33.09	30.35	1.1575	26.36	25.573	23.34	.9529	97
125	10.79	8.95	7.43	.6147	34.00	33.48	30.36	.9177	26.50	25.956	23.36	.7761	86
150	10.50	8.57	7.64	.5575	34.07	33.75	30.36	.6452	26.56	26.227	23.37	.5609	83
200	9.03	7.94	7.04	.4754	34.09	34.00	33.53	.0855	26.63	26.511	24.11	.0817	76
250	8.71	7.41	6.43	.5018	34.25	34.05	33.90	.0678	26.73	26.632	26.42	.0596	78
300	8.31	6.92	5.96	.4800	34.27	34.08	33.94	.0676	26.83	26.726	26.56	.0534	77
400	7.39	6.19	5.38	.4190	34.28	34.15	33.98	.0693	26.98	26.878	26.75	.0462	73
500	6.52	5.55	4.82	.3319	34.33	34.21	34.05	.0568	27.11	27.005	26.90	.0408	71
600	5.75	5.00	4.57	.2500	34.38	34.28	34.16	.0546	27.22	27.117	27.04	.0399	52
700	5.00	4.71	4.39	.1978	34.42	34.35	34.26	.0438	27.28	27.205	27.13	.0373	39
800	4.62	4.37	4.09	.1253	34.45	34.38	34.29	.0355	27.33	27.277	27.21	.0268	38
900	4.26	4.06	3.80	.1076	34.46	34.42	34.33	.0329	27.38	27.340	27.27	.0277	35
1000	3.93	3.78	3.60	.0851	34.51	34.46	34.36	.0332	27.45	27.397	27.32	.0279	30
1100	3.66	3.52	3.38	.0834	34.52	34.48	34.39	.0365	27.48	27.444	27.38	.0335	19
1200	3.33	3.26	3.25	.0354	34.54	34.51	34.50	.0191	27.51	27.492	27.48	.0150	4
1300	3.10	3.07	3.05	.0266	34.53	34.52	34.52	.0058	27.52	27.520	27.52	.0000	3
1400	2.89	2.86	2.86	.0153	34.55	34.54	34.52	.0153	27.56	27.543	27.53	.0153	3
1500	2.73	2.71	2.69	.0283	34.55	34.53	34.52	.0212	27.57	27.560	27.55	.0141	2
1750	2.34	2.31	2.27	.0495	34.58	34.57	34.57	.0071	27.63	27.630	27.63	.0000	2
2000	2.02	2.00	1.97	.0354	34.61	34.61	34.61	.0000	27.68	27.675	27.67	.0071	2
2500	1.77	1.77	1.77	.0000	34.64	34.64	34.64	.0000	27.73	27.730	27.73	.0000	1
3000	1.63	1.63	1.63	.0000	34.65	34.65	34.66	.0000	27.75	27.750	27.75	.0000	1

Figure C.11.

AREA TWELVE - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	11.89	9.77	7.40	.7179	32.96	32.56	32.26	.1257	25.53	25.100	24.87	.1086	163
10	11.86	9.75	7.40	.7225	32.96	32.56	32.27	.1268	25.53	25.105	24.87	.1110	163
20	11.88	9.72	7.44	.7217	32.96	32.56	32.27	.1276	25.52	25.111	24.87	.1138	163
30	11.87	9.69	7.48	.7216	33.06	32.57	32.26	.1333	25.53	25.123	24.87	.1187	163
50	11.80	9.63	7.63	.7125	33.23	32.61	32.26	.1663	25.76	25.167	24.88	.1501	163
75	10.72	9.12	7.63	.6334	33.64	32.94	32.43	.2647	26.19	25.504	25.04	.2404	163
100	9.91	8.52	7.56	.4605	33.81	33.38	32.50	.2342	26.37	25.946	25.21	.2052	161
125	9.78	8.16	7.42	.4107	33.90	33.65	32.95	.1441	26.44	26.209	25.71	.1312	159
150	9.46	7.69	7.13	.3794	33.96	33.80	33.30	.0906	26.51	26.370	26.07	.0944	156
200	8.90	7.31	6.67	.2818	34.05	33.93	33.68	.0455	26.64	26.551	26.23	.0584	149
250	8.52	6.75	5.84	.1673	34.06	33.97	33.82	.0339	26.76	26.658	26.39	.0503	147
300	8.00	6.26	5.63	.1482	34.07	34.00	33.91	.0307	26.85	26.747	26.48	.0418	142
400	6.55	5.55	4.70	.2172	34.14	34.06	33.96	.0313	26.98	26.882	26.73	.0395	138
500	5.97	5.09	4.20	.2414	34.21	34.13	34.01	.0312	27.06	26.999	26.79	.0369	138
600	5.49	4.66	4.19	.1993	34.25	34.20	34.08	.0289	27.15	27.088	26.90	.0346	135
700	4.90	4.35	4.03	.1200	34.32	34.27	34.13	.0245	27.23	27.185	27.06	.0276	129
800	4.39	4.06	3.82	.1030	34.37	34.32	34.20	.0243	27.30	27.262	27.16	.0237	127
900	4.13	3.79	3.51	.1018	34.43	34.37	34.31	.0200	27.37	27.328	27.27	.0229	123
1000	3.81	3.53	3.37	.0848	34.48	34.41	34.37	.0183	27.45	27.386	27.35	.0198	97
1100	3.48	3.29	3.13	.0771	34.50	34.44	34.40	.0158	27.49	27.433	27.38	.0178	62
1200	3.20	3.07	2.94	.0822	34.52	34.47	34.44	.0152	27.52	27.475	27.45	.0158	51
1300	2.98	2.87	2.72	.0473	34.51	34.49	34.48	.0099	27.53	27.511	27.50	.0097	20
1400	2.81	2.68	2.55	.0436	34.53	34.51	34.50	.0091	27.56	27.545	27.53	.0105	20
1500	2.59	2.50	2.41	.0551	34.54	34.53	34.51	.0093	27.59	27.574	27.56	.0105	20
1750	2.20	2.19	2.09	.0901	34.59	34.58	34.56	.0097	27.66	27.640	27.62	.0129	13
2000	1.95	1.91	1.86	.0219	34.62	34.61	34.59	.0085	27.70	27.686	27.67	.0077	13
2500	1.78	1.75	1.74	.0106	34.65	34.64	34.63	.0067	27.73	27.722	27.71	.0079	10

AREA TWELVE - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	20.26	16.25	9.40	1.4167	33.48	31.50	26.44	1.0216	25.73	23.014	18.96	.9552	386
10	19.83	15.91	9.44	1.5031	33.59	31.73	28.96	.7667	25.96	23.265	20.94	.7821	386
20	18.57	14.53	6.71	1.8913	33.70	32.20	30.81	.4430	26.16	23.919	22.52	.6111	384
30	18.52	12.76	7.32	2.0177	33.76	32.48	31.53	.2949	26.28	24.486	22.61	.5208	385
50	14.35	10.20	7.36	1.2951	33.93	32.66	32.14	.2561	26.54	25.101	24.19	.3189	376
75	11.90	8.99	7.19	.6086	33.96	32.86	32.42	.3091	26.59	25.460	24.62	.2969	361
100	10.39	8.43	7.04	.5361	33.93	33.23	32.54	.3047	26.50	25.835	25.18	.2691	333
125	9.76	8.12	7.04	.5414	33.95	33.53	32.77	.2170	26.56	26.124	25.39	.2011	321
150	9.36	7.49	6.98	.4031	33.98	33.74	33.15	.1448	26.62	26.325	25.71	.1457	317
200	8.51	7.07	6.67	.2806	34.04	33.91	33.43	.0438	26.71	26.541	26.14	.0843	267
250	7.88	6.71	6.06	.3326	34.08	33.94	33.63	.0478	26.79	26.654	26.39	.0594	232
300	7.28	6.24	5.55	.3158	34.13	33.99	33.86	.0430	26.85	26.746	26.58	.0463	216
400	6.55	5.52	4.83	.2883	34.17	34.06	33.94	.0426	26.98	26.884	26.77	.0374	209
500	5.83	5.03	4.48	.2226	34.25	34.13	34.01	.0378	27.08	27.003	26.66	.0339	199
600	5.43	4.64	4.20	.1830	34.32	34.20	34.06	.0364	27.20	27.102	26.94	.0313	188
700	4.89	4.33	3.98	.1423	34.88	34.27	34.19	.0394	27.50	27.190	27.04	.0347	182
800	4.47	4.05	3.72	.1204	34.71	34.33	34.25	.0381	27.57	27.265	27.17	.0321	178
900	4.16	3.80	3.59	.1086	34.53	34.37	34.25	.0261	27.45	27.327	27.24	.0296	172
1000	3.84	3.56	3.37	.0897	34.60	34.41	34.31	.0264	27.45	27.382	27.28	.0228	137
1100	3.60	3.33	3.15	.0902	34.55	34.44	34.36	.0293	27.50	27.424	27.36	.0252	82
1200	3.23	3.10	2.96	.0866	34.57	34.47	34.36	.0305	27.55	27.469	27.37	.0258	53
1300	3.01	2.92	2.79	.0623	34.55	34.49	34.46	.0198	27.55	27.508	27.48	.0170	18
1400	2.79	2.72	2.61	.0524	34.54	34.51	34.48	.0158	27.56	27.536	27.51	.0157	15
1500	2.62	2.53	2.45	.0433	34.55	34.53	34.48	.0202	27.59	27.570	27.54	.0140	12
1750	2.20	2.15	2.08	.0356	34.59	34.57	34.54	.0129	27.65	27.634	27.61	.0116	12
2000	1.95	1.92	1.68	.0223	34.65	34.60	34.57	.0212	27.73	27.682	27.66	.0143	10
2500	1.77	1.75	1.71	.0230	34.65	34.64	34.62	.0127	27.73	27.723	27.71	.0095	7

AREA TWELVE - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	16.36	12.35	8.39	1.9834	32.91	32.05	28.43	.9961	25.30	24.242	19.90	1.0321	277
10	16.15	12.16	8.50	1.8785	32.96	32.22	29.02	.6431	25.33	24.408	21.40	.7543	277
20	15.34	11.71	8.34	1.6558	33.08	32.41	30.79	.3489	25.51	24.644	22.69	.4780	277
30	14.39	11.08	8.19	1.3828	33.10	32.52	31.55	.1849	25.62	24.846	23.52	.3011	277
50	13.47	9.98	7.49	.9829	33.32	32.61	32.02	.1440	25.87	25.104	24.32	.1814	277
75	11.54	9.17	7.19	.7626	33.57	32.89	32.43	.2402	26.11	25.419	24.62	.2189	275
100	10.57	8.57	7.38	.5687	33.79	33.26	32.57	.2485	26.29	25.844	25.25	.2133	272
125	10.18	8.42	7.39	.4554	33.94	33.56	32.76	.1809	26.45	26.132	25.59	.1629	268
150	9.57	7.91	7.17	.3923	33.96	33.75	33.17	.1239	26.52	26.324	25.81	.1213	267
200	8.64	7.21	6.50	.3797	34.05	33.91	33.50	.0574	26.69	26.534	26.19	.0719	266
250	7.92	6.72	5.82	.3623	34.11	33.95	33.73	.0462	26.78	26.651	26.44	.0541	247
300	7.35	6.23	5.16	.3457	34.17	33.99	33.87	.0459	26.88	26.744	26.56	.0436	233
400	6.27	5.58	4.60	.2904	34.21	34.05	33.84	.0430	27.00	26.885	26.76	.0369	212
500	5.69	4.97	4.38	.2286	34.23	34.12	34.00	.0382	27.09	27.003	26.90	.0322	200
600	5.03	4.59	4.22	.1821	34.31	34.20	34.10	.0313	27.17	27.104	27.02	.0277	192
700	4.67	4.29	3.96	.1294	34.39	34.27	34.14	.0277	27.27	27.192	27.11	.0250	181
800	4.36	4.02	3.75	.1089	34.42	34.33	34.14	.0254	27.33	27.268	27.19	.0206	177
900	4.05	3.76	3.53	.0971	34.48	34.37	34.25	.0247	27.40	27.331	27.26	.0207	168
1000	3.77	3.51	3.35	.0893	34.50	34.41	34.33	.0222	27.46	27.387	27.33	.0200	160
1100	3.50	3.29	3.11	.0830	34.54	34.45	34.34	.0212	27.51	27.436	27.39	.0191	124
1200	3.26	3.05	2.91	.0746	34.57	34.47	34.45	.0119	27.50	27.479	27.46	.0130	84
1300	2.96	2.89	2.83	.0427	34.51	34.50	34.45	.0156	27.52	27.513	27.48	.0111	34
1400	2.77	2.70	2.64	.0907	34.53	34.52	34.50	.0083	27.56	27.546	27.54	.0072	13
1500	2.69	2.52	2.46	.0626	34.55	34.54	34.53	.0065	27.59	27.578	27.56	.0094	12
1750	2.23	2.14	2.06	.0463	34.58	34.57	34.57	.0053	27.65	27.641	27.63	.0083	12
2000	1.93	1.91	1.69	.0151	34.62	34.61	34.60	.0076	27.69	27.685	27.68	.0053	8
2500	1.78	1.76	1.74	.0107	34.65	34.64	34.63	.0053	27.74	27.725	27.72	.0076	8

AREA TWELVE - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	17.82	13.38	9.96	1.7243	32.98	32.37	31.51	.2221	24.99	24.289	22.89	.4261	229
10	17.75	13.34	9.96	1.7173	33.02	32.37	31.51	.2224	25.12	24.298	22.94	.4243	229
20	17.73	13.17	9.72	1.6878	33.14	32.40	31.82	.2249	25.57	24.352	22.96	.4195	229
30	16.83	12.46	9.83	1.6497	33.26	32.56	31.94	.2357	25.73	24.497	23.39	.4188	229
50	15.72	10.59	7.05	1.5255	33.56	32.71	32.26	.2777	26.02	25.085	24.16	.3870	229
75	13.44	8.90	7.05	.7995	33.79	33.06	32.49	.3213	26.27	25.628	24.59	.2907	228
100	12.58	8.39	7.01	.4856	33.86	33.40	32.54	.2867	26.44	25.981	25.36	.2293	222
125	9.38	8.06	7.06	.3628	33.97	33.64	32.94	.1789	26.57	26.213	25.67	.1554	220
150	8.85	7.79	6.88	.3321	33.96	33.79	33.39	.1061	26.61	26.378	26.00	.1010	218
200	8.38	7.23	6.42	.3578	34.02	33.93	33.76	.0951	26.70	26.561	26.38	.0565	213
250	7.87	6.70	5.98	.3762	34.06	33.97	33.83	.0383	26.78	26.669	26.53	.0494	201
300	7.68	6.23	5.43	.3749	34.09	33.99	33.85	.0360	26.86	26.746	26.57	.0438	177
400	6.60	5.51	4.81	.3069	34.14	34.05	33.92	.0357	26.96	26.880	26.75	.0349	171
500	5.89	5.02	4.41	.2491	34.20	34.12	34.02	.0311	27.08	26.995	26.87	.0325	170
600	5.78	4.69	4.18	.1817	34.27	34.19	34.11	.0303	27.17	27.094	27.00	.0297	164
700	4.75	4.33	4.04	.1376	34.36	34.26	34.15	.0277	27.27	27.184	27.11	.0270	156
800	4.81	4.05	3.74	.1291	34.38	34.32	34.19	.0239	27.38	27.260	27.18	.0257	152
900	4.08	3.78	3.53	.1082	34.46	34.37	34.25	.0238	27.40	27.324	27.25	.0230	148
1000	3.79	3.52	3.28	.0948	34.46	34.41	34.30	.0214	27.43	27.381	27.29	.0210	119
1100	3.59	3.31	3.10	.0917	34.51	34.44	34.35	.0180	27.50	27.427	27.35	.0179	88
1200	3.52	3.10	2.93	.1076	34.55	34.46	34.42	.0192	27.55	27.469	27.43	.0190	58
1300	3.05	2.88	2.72	.0940	34.57	34.49	34.47	.0198	27.59	27.507	27.49	.0199	24
1400	2.88	2.69	2.62	.0903	34.57	34.51	34.48	.0176	27.61	27.539	27.52	.0200	23
1500	2.81	2.52	2.36	.0687	34.58	34.52	34.50	.0169	27.62	27.568	27.55	.0155	21
1750	2.76	2.15	2.07	.0554	34.56	34.56	34.54	.0105	27.65	27.631	27.61	.0091	20
2000	1.95	1.90	1.84	.0337	34.62	34.60	34.57	.0121	27.70	27.676	27.65	.0112	19
2500	1.78	1.75	1.71	.0156	34.64	34.63	34.60	.0103	27.73	27.719	27.69	.0117	17

Figure C.12.

AREA THIRTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.97	17.59	14.08	.9831	35.25	34.82	33.82	.3028	25.43	25.147	24.80	.1197	184
10	19.97	17.98	14.01	.9928	35.26	34.82	33.84	.2991	25.44	25.152	24.80	.1174	184
20	20.00	17.97	13.92	.9905	35.26	34.83	33.84	.2961	25.44	25.157	24.80	.1186	184
30	20.02	17.96	13.68	.9906	35.25	34.83	33.84	.2948	25.44	25.161	24.80	.1183	184
50	20.00	17.94	13.86	.9957	35.25	34.83	33.83	.2916	25.46	25.165	24.81	.1197	184
75	20.05	17.93	13.86	1.0006	35.22	34.83	33.65	.2850	25.46	25.172	24.81	.1217	184
100	19.80	17.81	13.79	1.0120	35.22	34.82	33.65	.2827	25.54	25.190	24.65	.1190	184
125	18.97	17.07	14.86	1.1264	35.19	34.70	33.67	.2904	25.74	25.279	25.00	.1211	183
150	18.71	15.58	11.49	1.5030	35.13	34.55	33.71	.2897	25.96	25.409	25.11	.1504	182
200	16.92	13.27	10.12	1.2568	34.72	34.22	33.73	.1659	26.15	25.741	25.27	.1677	181
250	13.37	11.41	9.31	.6874	34.26	34.11	33.85	.0799	26.30	26.025	25.66	.1083	181
300	11.02	10.08	8.43	.4383	34.18	34.07	33.93	.0539	26.41	26.238	26.02	.0647	181
400	8.89	7.92	6.49	.3578	34.12	34.01	33.92	.0278	26.67	26.526	26.38	.0471	174
500	7.94	6.18	5.12	.2758	34.15	34.00	33.81	.0338	26.88	26.757	26.50	.0428	167
600	6.71	5.16	4.48	.2224	34.18	34.06	33.89	.0376	27.01	26.935	26.70	.0387	152
700	5.09	4.65	4.19	.1766	34.29	34.17	33.98	.0425	27.14	27.073	26.95	.0324	118
800	4.53	4.28	3.84	.1493	34.33	34.26	34.05	.0427	27.25	27.192	27.05	.0318	110
900	4.15	3.95	3.67	.1280	34.40	34.35	34.16	.0374	27.34	27.289	27.16	.0268	44
1000	3.87	3.66	3.33	.1904	34.45	34.40	34.33	.0322	27.41	27.365	27.30	.0235	39
1100	3.62	3.45	3.10	.1433	34.49	34.44	34.37	.0354	27.46	27.421	27.36	.0233	25
1200	3.41	3.26	2.90	.1542	34.52	34.48	34.38	.0398	27.50	27.466	27.39	.0287	17
1300	3.21	3.12	2.89	.0873	34.54	34.51	34.42	.0382	27.53	27.501	27.42	.0291	14
1400	3.08	2.95	2.60	.1178	34.55	34.52	34.44	.0363	27.55	27.529	27.45	.0276	14
1500	2.90	2.77	2.35	.1342	34.58	34.54	34.45	.0383	27.59	27.560	27.48	.0240	14
1750	2.45	2.31	2.11	.1261	34.58	34.56	34.52	.0249	27.64	27.620	27.58	.0235	5
2000	2.15	2.02	1.93	.0817	34.61	34.60	34.56	.0219	27.68	27.668	27.64	.0164	5
2500	1.79	1.73	1.70	.0423	34.65	34.62	34.59	.0250	27.73	27.710	27.69	.0163	4
3000	1.64	1.57	1.53	.0586	34.66	34.64	34.60	.0321	27.75	27.733	27.71	.0208	3

AREA THIRTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.39	22.35	12.58	1.4716	35.54	34.93	32.71	.3847	25.11	24.075	22.20	.3283	265
10	26.31	22.20	12.19	1.5328	35.53	34.94	32.75	.3882	25.27	24.120	22.28	.3235	264
20	25.75	21.92	11.71	1.6216	35.53	34.96	32.77	.3749	25.44	24.213	22.45	.3079	264
30	24.50	21.55	11.11	1.7637	35.52	34.96	32.80	.3789	25.62	24.317	23.17	.3009	264
50	23.25	19.72	9.76	1.7274	35.38	34.88	32.89	.3543	25.96	24.727	23.93	.2200	263
75	21.71	18.29	9.20	1.4358	35.29	34.77	33.20	.2996	26.12	25.033	24.46	.1473	261
100	19.88	17.63	8.89	1.3394	35.25	34.74	33.49	.2535	26.25	25.175	24.92	.1455	260
125	19.09	17.01	8.79	1.2683	35.13	34.68	33.71	.2280	26.22	25.271	24.94	.1385	259
150	18.32	16.14	8.85	1.3412	35.05	34.57	33.75	.2289	26.35	25.373	25.11	.1459	259
200	16.58	13.88	7.77	1.2686	34.88	34.25	33.75	.1667	26.54	25.725	25.33	.1627	256
250	13.26	11.52	6.99	.8277	34.42	34.14	33.81	.0838	26.65	26.025	25.79	.1098	255
300	11.19	10.08	6.41	.5763	34.35	34.08	33.89	.0452	26.74	26.242	26.03	.0837	254
400	9.07	7.92	5.98	.4026	34.24	34.01	33.84	.0338	26.89	26.530	26.35	.0601	242
500	6.90	6.19	5.34	.2582	34.22	34.01	33.84	.0357	27.01	26.768	26.67	.0416	239
600	5.95	5.19	4.71	.2054	34.28	34.07	33.98	.0344	27.12	26.950	26.83	.0361	222
700	5.29	4.66	4.22	.1932	34.33	34.18	34.06	.0355	27.20	27.078	26.95	.0315	152
800	4.73	4.28	3.89	.1632	34.38	34.27	34.15	.0313	27.29	27.197	27.08	.0297	149
900	4.29	3.96	3.69	.1228	34.42	34.35	34.25	.0235	27.34	27.293	27.21	.0213	127
1000	3.90	3.66	3.50	.1110	34.46	34.41	34.27	.0265	27.41	27.369	27.27	.0230	47
1100	3.58	3.42	3.30	.1158	34.46	34.44	34.41	.0175	27.44	27.415	27.39	.0187	6
1200	3.34	3.20	3.08	.1044	34.51	34.47	34.44	.0235	27.51	27.470	27.43	.0268	6
1300	3.11	3.00	2.88	.0884	34.53	34.50	34.44	.0256	27.54	27.505	27.48	.0235	5
1400	2.92	2.79	2.66	.1122	34.55	34.52	34.50	.0182	27.56	27.534	27.51	.0195	5
1500	2.75	2.62	2.51	.1038	34.57	34.54	34.51	.0219	27.60	27.566	27.54	.0230	5
1750	2.42	2.29	2.17	.1032	34.61	34.58	34.54	.0329	27.67	27.628	27.60	.0342	5
2000	2.07	2.01	1.94	.0581	34.65	34.60	34.59	.0436	27.73	27.670	27.64	.0394	5
2500	1.69	1.68	1.68	.0058	34.65	34.62	34.59	.0300	27.75	27.717	27.69	.0306	3
3000	1.59	1.53	1.42	.0100	34.66	34.64	34.61	.0252	27.76	27.743	27.73	.0115	3
4000	1.54	1.54	1.54	.0000	34.66	34.66	34.66	.0000	27.76	27.760	27.76	.0000	1
5000	1.54	1.54	1.54	.0000	34.66	34.66	34.66	.0000	27.76	27.760	27.76	.0000	1

AREA THIRTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	23.33	19.28	15.81	1.6083	35.50	34.89	33.84	.2836	25.36	24.873	23.93	.3327	191
10	23.31	19.18	15.80	1.6292	35.50	34.89	33.90	.2822	25.36	24.899	23.93	.3152	190
20	22.85	18.95	15.79	1.5311	35.50	34.90	33.87	.2798	25.36	24.940	23.98	.2593	190
30	22.63	18.76	15.77	1.2057	35.50	34.90	33.86	.2749	25.37	25.012	24.15	.2129	190
50	21.88	18.38	15.47	1.0993	35.44	34.88	33.84	.2523	25.44	25.103	24.35	.1328	190
75	20.72	18.08	12.82	.9132	35.38	34.85	33.84	.2292	25.54	25.173	24.69	.1001	190
100	20.00	17.73	12.18	.8700	35.37	34.80	33.81	.2119	25.71	25.229	24.80	.0878	190
125	19.30	17.09	12.03	.9658	35.23	34.73	33.81	.2152	25.88	25.310	24.81	.0933	190
150	18.76	16.11	12.03	1.1378	35.15	34.59	33.80	.2327	26.12	25.418	24.91	.1175	189
200	16.08	13.59	10.40	1.3853	34.86	34.28	33.75	.1970	26.26	25.724	25.13	.1543	189
250	13.35	11.75	9.67	.9598	34.75	34.14	33.97	.0907	26.42	26.000	25.31	.1279	187
300	12.55	10.32	8.84	.6110	34.69	34.11	33.97	.0610	26.46	26.218	25.60	.0933	185
400	10.73	8.12	6.59	.4830	34.59	34.03	33.96	.0492	26.67	26.507	26.23	.0750	175
500	12.30	6.30	5.59	.4208	34.56	34.01	33.96	.0446	26.86	26.747	26.13	.0587	175
600	6.50	5.20	4.71	.3872	34.28	34.04	33.98	.0386	27.03	26.930	26.49	.0462	161
700	5.50	4.70	4.36	.3242	34.27	34.17	34.07	.0380	27.16	27.073	26.75	.0426	100
800	4.81	4.29	3.97	.2216	34.35	34.27	34.15	.0321	27.28	27.196	26.99	.0373	97
900	4.31	3.97	3.71	.1685	34.42	34.35	34.21	.0307	27.36	27.293	27.09	.0313	46
1000	3.91	3.65	3.38	.1296	34.48	34.41	34.24	.0338	27.45	27.370	27.21	.0310	42
1100	3.62	3.53	3.23	.1245	34.52	34.48	34.43	.0202	27.51	27.439	27.40	.0254	13
1200	3.38	3.33	3.15	.0836	34.52	34.50	34.46	.0129	27.50	27.481	27.46	.0124	12
1300	3.22	3.15	3.08	.0373	34.52	34.52	34.50	.0062	27.53	27.515	27.50	.0093	12
1400	3.05	2.97	2.91	.0384	34.55	34.55	34.52	.0101	27.55	27.544	27.53	.0075	11
1500	2.85	2.79	2.76	.0236	34.56	34.55	34.54	.0067	27.58	27.576	27.55	.0067	11
1750	2.40	2.40	2.40	.0000	34.59	34.59	34.59	.0000	27.63	27.630	27.63	.0000	1
2000	2.10	2.10	2.10	.0000	34.62	34.62	34.62	.0000	27.68	27.680	27.68	.0000	1
2500	1.76	1.76	1.76	.0000	34.65	34.65	34.65	.0000	27.73	27.730	27.73	.0000	1
3000	1.58	1.58	1.58	.0000	34.66	34.66	34.66	.0000	27.75	27.750	27.75	.0000	1

AREA THIRTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	24.84	21.29	17.55	1.2897	35.44	35.03	34.10	.2487	25.19	24.450	23.64	.3081	202
10	23.95	21.26	17.58	1.2674	35.44	35.04	34.09	.2458	25.18	24.456	23.62	.3020	201
20	23.45	21.26	17.56	1.2551	35.44	35.04	34.09	.2458	25.19	24.463	23.65	.2979	201
30	22.89	21.25	17.58	1.2502	35.45	35.05	34.08	.2431	25.19	24.471	23.87	.2924	201
50	22.30	21.02	16.95	1.0113	35.46	34.99	33.94	.2544	25.20	24.599	24.03	.2209	201
75	21.00	19.18	16.41	1.0637	35.46	34.94	33.88	.2721	25.27	24.878	24.08	.1602	200
100	20.41	18.09	14.27	1.0816	35.40	34.88	33.86	.2661	25.36	25.085	24.33	.1358	200
125	19.95	17.19	12.98	1.0878	35.32	34.76	33.84	.2465	25.55	25.220	24.61	.1162	199
150	18.81	16.12	12.58	1.1684	35.28	34.63	33.83	.2293	25.73	25.372	24.89	.1121	199
200	15.81	13.21	10.60	.9792	34.82	34.27	33.84	.1620	26.08	25.738	25.38	.1082	198
250	12.97	11.31	9.28	.7404	34.30	34.11	33.89	.0968	26.46	26.039	25.75	.0866	197
300	11.39	9.90	7.75	.6234	34.19	34.07	33.93	.0532	26.62	26.258	26.00	.0775	196
400	9.07	7.82	6.72	.4954	34.09	34.01	33.92	.0290	26.70	26.591	26.40	.0621	192
500	7.20	6.17	5.61	.2970	34.08	34.01	33.93	.0290	26.90	26.768	26.64	.0495	188
600	6.39	5.18	4.59	.2251	34.18	34.08	33.96	.0388	27.05	26.943	26.81	.0429	172
700	5.29	4.69	4.30	.1858	34.27	34.18	34.06	.0413	27.18	27.082	26.90	.0387	126
800	4.76	4.25	3.92	.1476	34.37	34.28	34.17	.0311	27.29	27.204	27.13	.0311	121
900	4.22	3.90	3.69	.1151	34.43	34.35	34.27	.0285	27.37	27.299	27.23	.0250	108
1000	3.83	3.63	3.22	.1166	34.48	34.41	34.34	.0213	27.42	27.378	27.31	.0205	49
1100	3.59	3.42	3.22	.1406	34.49	34.45	34.38	.0127	27.45	27.428	27.40	.0190	10
1200	3.22	3.17	3.12	.0707	34.50	34.49	34.48	.0071	27.48	27.480	27.48	.0000	2
1300	3.09	2.96	2.84	.0778	34.52	34.52	34.51	.0071	27.52	27.520	27.52	.0000	2
1400	2.87	2.81	2.76	.0778	34.55	34.55	34.54	.0071	27.56	27.560	27.56	.0000	2
1500	2.70	2.65	2.60	.0707	34.57	34.57	34.56	.0071	27.59	27.590	27.59	.0000	2
1750	2.32	2.30	2.28	.0283	34.60	34.59	34.59	.0071	27.64	27.640	27.64	.0000	2

Figure C.13.

AREA FOURTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.92	24.66	22.00	1.0955	35.13	34.39	33.84	.2720	24.00	22.998	21.98	.3593	92
10	27.95	24.69	22.05	1.0526	35.15	34.40	33.83	.2713	24.00	23.007	21.98	.3639	92
20	27.93	24.55	23.09	1.0553	35.13	34.42	33.89	.2698	24.00	23.039	21.98	.3736	92
30	27.93	24.54	24.01	1.0692	35.13	34.44	33.96	.2783	24.00	23.070	22.02	.3886	92
50	27.95	24.42	21.67	1.1174	35.18	34.49	34.00	.2979	24.16	23.141	22.11	.4216	92
75	27.56	23.29	16.67	1.9994	35.25	34.64	34.00	.2916	25.23	23.592	22.50	.6027	92
100	26.75	20.88	12.69	3.0671	35.39	34.79	34.33	.2525	26.05	24.341	22.81	.6951	91
125	26.43	18.66	11.01	3.5532	35.29	34.80	34.26	.2817	26.40	24.911	22.86	.6976	91
150	24.02	16.71	11.01	3.5184	35.25	34.73	34.25	.2738	26.52	25.332	23.65	.6616	91
200	19.56	13.37	10.02	2.6562	35.13	34.64	34.14	.2111	26.63	25.946	24.94	.5078	91
250	19.46	11.17	9.54	1.3222	34.75	34.45	34.14	.1952	26.73	26.326	25.43	.3342	91
300	11.56	9.49	[illegible]	.6071	34.71	34.44	34.06	.2130	26.80	26.550	26.00	.2110	91
400	9.43	8.36	[illegible]	.6198	34.67	34.45	34.06	.1786	26.92	26.801	26.58	.0831	91
500	8.65	7.38	[illegible]	.4914	34.63	34.47	34.18	.1191	27.05	26.963	26.67	.0458	89
600	7.62	6.50	5.34	.5303	34.58	34.47	34.29	.0737	27.18	27.085	27.00	.0370	87
700	6.67	5.82	4.91	.4198	34.56	34.49	34.37	.0490	27.26	27.187	27.11	.0349	84
800	6.11	5.25	4.57	.3362	34.55	34.50	34.40	.0326	27.33	27.267	27.17	.0286	82
900	5.39	4.81	4.22	.2650	34.55	34.52	34.44	.0218	27.38	27.331	27.27	.0244	82
1000	4.71	4.41	3.90	.2203	34.56	34.53	34.48	.0193	27.45	27.387	27.33	.0222	81
1100	4.51	4.06	3.69	.1923	34.58	34.54	34.50	.0184	27.50	27.437	27.39	.0226	81
1200	4.19	3.76	[illegible]	[illegible]	34.59	34.56	34.52	.0154	27.53	27.483	27.44	.0193	78
1300	3.83	3.49	3.19	.1502	34.60	34.57	34.54	.0135	27.55	27.519	27.48	.0166	72
1400	3.55	3.24	2.98	.1398	34.61	34.58	34.55	.0118	27.59	27.546	27.52	.0149	65
1500	3.31	2.99	2.76	.1360	34.61	34.59	34.56	.0120	27.61	27.578	27.55	.0152	33
1750	2.72	2.57	2.52	.0763	34.62	34.61	34.61	.0055	27.64	27.637	27.62	.0082	6
2000	2.33	2.21	2.16	.0637	34.64	34.63	34.63	.0052	27.69	27.682	27.67	.0075	6
2500	1.92	1.86	1.77	.0547	34.66	34.66	34.65	.0055	27.73	27.730	27.73	.0000	5
3000	1.76	1.69	1.62	.0526	34.68	34.67	34.67	.0045	27.76	27.764	27.75	.0044	5
4000	1.44	1.43	1.42	.0101	34.70	34.68	34.64	.0321	27.79	27.777	27.75	.0231	3
5000	1.41	1.41	1.41	.0000	34.70	34.70	34.70	.0000	27.79	27.790	27.79	.0000	1

AREA FOURTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.89	26.31	25.63	.4956	35.28	34.56	33.26	.4428	23.48	22.615	21.25	.5206	47
10	26.85	26.26	25.63	.4443	35.28	34.58	33.28	.4066	23.48	22.649	21.48	.4441	47
20	26.01	25.55	22.78	1.0733	35.29	34.63	33.66	.3263	23.52	22.784	21.74	.3924	47
30	28.73	25.41	19.33	1.4954	35.28	34.67	33.94	.2735	24.17	22.911	21.77	.4202	47
50	26.80	24.64	19.43	2.4765	35.26	34.72	34.20	.2313	25.62	23.168	21.60	.6578	47
75	27.89	23.37	14.04	3.1991	35.26	34.79	34.27	.2297	26.14	23.639	22.31	.7762	47
100	26.92	21.37	11.19	3.7384	35.26	34.89	34.37	.2268	26.37	24.260	22.98	.8183	47
125	25.96	19.59	10.66	3.7946	35.27	34.91	34.37	.2300	26.52	24.754	23.27	.7792	47
150	24.67	17.75	10.61	3.6953	35.21	34.87	34.30	.2184	26.59	25.177	23.61	.7173	47
200	18.87	14.22	9.97	2.8163	34.93	34.62	34.12	.2019	26.69	25.827	25.01	.5478	47
250	15.55	11.56	9.50	1.4878	34.85	34.46	34.12	.2120	26.76	26.258	25.55	.3721	47
300	12.12	10.10	6.96	.6522	34.81	34.42	34.09	.2281	26.83	26.498	25.96	.2318	45
400	10.25	8.41	7.19	.6281	34.78	34.40	34.08	.1987	27.00	26.758	26.55	.1134	42
500	9.11	7.25	5.69	.6756	34.71	34.42	34.17	.1466	27.11	26.951	26.83	.0696	42
600	7.49	6.41	5.32	.5133	34.63	34.45	34.29	.0861	27.20	27.080	27.00	.0423	40
700	6.38	5.77	4.92	.3796	34.60	34.48	34.39	.0540	27.29	27.187	27.13	.0354	38
800	5.71	5.20	4.54	.2892	34.59	34.50	34.44	.0395	27.36	27.273	27.23	.0279	38
900	5.17	4.75	4.23	.2266	34.64	34.51	34.45	.0395	27.41	27.334	27.29	.0286	38
1000	4.70	4.39	3.95	.1806	34.66	34.52	34.43	.0410	27.46	27.390	27.31	.0310	35
1100	4.34	4.00	3.68	.1656	34.68	34.54	34.46	.0349	27.51	27.440	27.38	.0270	33
1200	4.00	3.70	3.43	.1473	34.60	34.55	34.48	.0226	27.53	27.480	27.42	.0220	30
1300	3.73	3.42	3.16	.1406	34.59	34.56	34.54	.0163	27.56	27.515	27.48	.0185	27
1400	3.52	3.17	2.92	.1456	34.60	34.57	34.54	.0156	27.59	27.547	27.50	.0210	25
1500	3.14	2.91	2.72	.1511	34.60	34.58	34.55	.0173	27.60	27.576	27.55	.0196	10
1750	2.59	2.44	2.28	.1054	34.61	34.59	34.57	.0200	27.65	27.623	27.61	.0231	3
2000	2.21	2.16	2.10	.0776	34.62	34.61	34.61	.0071	27.68	27.670	27.66	.0141	2
2500	1.80	1.79	1.78	.0141	34.65	34.65	34.65	.0000	27.73	27.730	27.73	.0000	2
3000	1.64	1.61	1.59	.0354	34.67	34.66	34.66	.0071	27.76	27.755	27.75	.0071	2
4000	1.43	1.42	1.42	.0071	34.68	34.67	34.67	.0071	27.78	27.775	27.77	.0071	2
5000	1.37	1.37	1.37	.0000	34.68	34.68	34.68	.0000	27.79	27.790	27.79	.0000	1

AREA FOURTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.89	[illegible]	23.39	.9683	34.91	34.57	34.08	.1620	23.53	22.922	21.99	.2832	89
10	27.89	[illegible]	23.44	.9676	34.92	34.53	34.07	.1615	23.54	22.930	21.99	.2844	88
20	27.82	25.12	23.43	.9680	34.92	34.54	34.19	.1517	23.56	22.974	22.01	.2886	88
30	27.75	25.01	23.36	.9866	34.91	34.56	34.18	.1484	23.63	23.018	22.04	.3016	88
50	27.61	24.75	23.12	1.0554	34.98	34.59	34.16	.1592	23.83	23.117	22.09	.3443	88
75	26.76	23.94	17.61	1.4481	35.12	34.66	34.17	.1799	25.02	23.511	22.45	.4711	88
100	25.90	21.94	13.39	2.1876	35.18	34.79	34.25	.1882	25.92	24.072	22.65	.5575	88
125	23.27	19.59	11.64	3.2294	35.20	34.85	34.28	.2268	[illegible]	24.731	23.65	.5735	88
150	21.75	17.51	11.39	3.2102	35.19	34.77	34.25	.2459	26.52	25.204	24.10	.5401	88
200	18.86	13.70	10.27	2.6437	35.00	34.62	34.16	.2119	26.62	25.867	25.06	.4914	88
250	14.50	11.29	9.25	1.2194	34.75	34.43	34.14	.1870	26.73	26.265	25.62	.3184	88
300	11.52	10.07	[illegible]	[illegible]	34.75	34.44	34.10	.2037	26.82	26.527	26.10	.1934	88
400	9.50	8.57	7.32	.4936	34.69	34.47	34.10	.1431	26.93	26.785	26.54	.0814	87
500	8.64	7.96	5.96	[illegible]	34.62	34.47	34.20	.1161	27.05	26.954	26.67	.0376	87
600	7.73	6.60	5.37	.5070	34.59	34.49	34.31	.0756	27.15	27.074	27.00	.0308	87
700	6.70	5.90	5.05	[illegible]	34.56	34.49	34.38	.0483	27.23	27.176	27.11	.0251	87
800	5.93	5.32	4.69	[illegible]	34.55	34.50	34.38	.0329	27.30	27.258	27.19	.0230	87
900	[illegible]	4.86	4.35	[illegible]	34.56	34.51	34.41	.0267	27.37	27.323	27.26	.0228	87
1000	[illegible]	4.45	4.04	[illegible]	34.56	34.53	34.46	.0216	27.42	27.381	27.31	.0215	83
1100	4.56	4.11	3.60	[illegible]	34.58	34.55	34.50	.0171	27.46	27.431	27.39	.0191	81
1200	4.08	3.76	3.20	[illegible]	34.59	34.55	34.51	.0171	27.51	27.477	27.41	.0203	80
1300	3.78	3.49	3.20	.1316	34.60	34.57	34.52	.0140	27.54	27.514	27.48	.0154	76
1400	3.55	3.24	2.96	.1226	34.61	34.58	34.54	.0127	27.56	27.545	27.50	.0158	69
1500	3.16	2.99	2.81	.1051	34.61	34.59	34.56	.0128	27.60	27.577	27.55	.0135	26
1750	2.64	2.51	2.38	[illegible]	34.62	34.62	34.60	.0116	27.66	27.642	27.63	.0109	6
2000	2.25	2.18	2.06	.0800	34.65	34.63	34.62	.0125	27.71	27.689	27.67	.0125	4
2500	1.92	1.89	1.86	.0522	34.66	34.66	34.64	.0130	27.75	27.739	27.71	.0194	4
3000	1.69	1.68	1.63	.0253	34.67	34.66	34.67	.0071	27.77	27.759	27.75	.0065	4
4000	[illegible]	[illegible]	1.40	.0134	34.70	34.69	34.70	.0040	27.79	27.784	27.77	.0079	2
5000	1.53	1.52	1.51	.0141	34.70	34.70	34.70	.0000	27.80	27.795	27.79	.0071	2

AREA FOURTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.71	28.20	24.37	.9686	34.95	34.21	33.55	.4048	23.51	22.392	21.13	.4443	56
10	28.37	[illegible]	24.35	[illegible]	34.95	34.23	33.61	.3900	23.52	22.412	21.56	.4727	56
20	28.30	26.82	24.01	1.0773	34.96	34.34	33.67	.3300	23.54	22.603	21.58	.4366	56
30	28.27	[illegible]	20.91	1.3764	34.98	34.45	33.79	.2843	24.07	22.824	21.69	.4565	56
50	28.18	24.24	17.13	2.1756	35.04	34.62	33.81	.2507	25.19	23.285	21.75	.6480	56
75	28.14	22.01	12.26	3.3582	35.14	34.73	33.71	.2417	25.93	23.962	22.01	.8427	56
100	24.14	19.62	11.62	4.2324	35.19	34.75	34.29	.2542	26.32	24.610	22.35	.9278	56
125	24.81	17.65	10.65	[illegible]	35.21	34.74	34.25	.2442	26.48	25.078	22.35	.9046	56
150	23.23	15.67	10.43	[illegible]	35.28	34.67	34.25	.2419	26.55	25.465	23.81	.8006	56
200	21.08	12.93	9.62	[illegible]	35.18	34.56	34.13	.2058	26.67	26.034	24.90	.5670	56
250	16.56	10.92	9.05	1.4911	35.18	34.49	34.18	.1967	26.77	26.399	25.37	.3520	55
300	12.39	9.84	8.62	.7779	34.86	34.50	34.13	.1913	26.86	26.600	25.96	.2232	55
400	9.94	8.50	7.67	.5734	34.67	34.50	34.12	.1452	26.98	26.817	26.56	.0993	55
500	8.59	7.45	6.29	.5481	34.66	34.49	34.19	.1054	27.08	26.968	26.83	.0405	55
600	7.50	6.57	5.75	.4503	34.58	34.49	34.32	.0652	27.19	27.090	27.00	.0463	55
700	6.49	5.86	5.22	.3536	34.55	34.49	34.37	.0438	27.26	27.188	27.08	.0384	55
800	5.89	5.28	4.82	.2752	34.55	34.50	34.39	.0341	27.32	27.267	27.17	.0356	53
900	5.35	4.92	4.46	.2231	34.55	34.52	34.42	.0293	27.39	27.330	27.25	.0313	52
1000	4.83	4.42	4.11	.1856	34.56	34.53	34.44	.0267	27.43	27.386	27.31	.0282	49
1100	4.39	4.07	3.81	.1590	34.57	34.55	34.42	.0302	27.48	27.434	27.37	.0314	48
1200	4.09	3.75	3.52	.1456	34.59	34.56	34.46	.0223	27.52	27.483	27.41	.0245	42
1300	3.72	3.46	3.23	.1334	34.59	34.57	34.53	.0142	27.56	27.520	27.48	.0186	31
1400	3.44	3.21	2.97	.1272	34.60	34.58	34.55	.0140	27.59	27.551	27.51	.0143	[illegible]
1500	3.14	3.00	2.85	.1070	34.61	34.59	34.56	.0135	27.61	27.579	27.54	.0144	21
1750	2.64	2.54	2.40	.0786	34.62	34.61	34.58	.0127	27.65	27.633	27.62	.0095	10
2000	2.29	2.20	2.11	.0602	34.64	34.63	34.62	.0076	27.70	27.682	27.67	.0089	7
2500	1.93	1.87	1.82	.0432	34.67	34.65	34.63	.0127	27.75	27.730	27.71	.0115	7
3000	1.72	1.65	1.61	.0286	34.67	34.67	34.63	.0197	27.77	27.753	27.71	.0137	5
4000	1.47	1.43	1.38	.0473	34.69	34.67	34.66	.0173	27.78	27.777	27.77	.0058	3

Figure C.14.

AREA FIFTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	20.20	18.66	17.05	1.0084	35.09	34.61	33.86	.3440	25.03	24.822	24.64	.0973	23
10	20.19	18.66	17.06	1.0034	35.09	34.61	33.84	.3424	25.03	24.821	24.63	.0940	23
20	20.72	18.67	17.06	.9984	35.09	34.62	33.84	.3368	25.02	24.826	24.63	.0947	23
30	20.23	18.68	17.06	.9920	35.09	34.63	33.85	.3304	25.00	24.831	24.63	.0934	23
50	20.72	18.72	17.07	.9804	35.08	34.64	33.86	.3246	25.00	24.843	24.64	.0925	23
75	20.27	18.76	17.11	.9869	35.12	34.67	33.90	.3230	25.00	24.860	24.66	.0948	23
100	20.75	18.99	16.33	1.1013	35.12	34.67	33.92	.3178	25.14	24.909	24.74	.0946	23
125	19.62	17.79	16.60	1.1934	35.08	34.61	34.04	.2706	25.29	25.034	24.84	.1130	23
150	18.52	16.75	14.17	1.2254	34.87	34.60	34.00	.2518	25.48	25.198	24.98	.1326	23
200	16.58	13.44	11.30	1.4098	34.98	34.15	33.80	.2218	25.91	25.611	25.38	.1351	23
250	12.80	11.10	9.40	1.0036	34.18	34.03	33.86	.0968	26.26	26.019	25.78	.1289	23
300	10.91	9.43	8.23	.7101	34.14	34.01	33.81	.0691	26.51	26.289	26.10	.1136	23
400	7.79	7.28	6.59	.4372	34.09	34.01	33.82	.0527	26.77	26.620	26.45	.0733	23
500	6.44	5.94	5.61	.2546	34.23	34.09	33.96	.0412	26.96	26.861	26.75	.0538	21
600	5.76	5.26	4.90	.2535	34.34	34.20	34.04	.0779	27.14	27.032	26.90	.0604	16
700	5.17	4.84	4.61	.2037	34.39	34.30	34.20	.0569	27.23	27.158	27.08	.0486	12
800	4.65	4.43	4.19	.1620	34.45	34.38	34.32	.0409	27.30	27.267	27.23	.0261	12
900	4.26	4.06	3.92	.1394	34.51	34.49	34.41	.0333	27.38	27.394	27.31	.0226	8
1000	3.75	3.75	3.75	.0000	34.50	34.50	34.50	.0000	27.43	27.430	27.43	.0000	1
1100	3.57	3.57	3.57	.0000	34.53	34.53	34.53	.0000	27.48	27.480	27.48	.0000	1

AREA FIFTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	23.52	21.05	19.29	1.1558	35.09	34.62	33.98	.2997	24.65	24.203	23.68	.2620	47
10	23.11	20.89	19.27	1.1196	35.10	34.62	33.98	.3041	24.65	24.243	23.82	.2316	47
20	22.95	20.77	19.21	1.0317	35.10	34.63	33.96	.2897	24.66	24.285	23.87	.2026	47
30	22.98	20.59	18.92	.9934	35.11	34.64	33.95	.2745	24.68	24.345	23.96	.1811	47
50	22.37	19.64	16.86	1.1751	35.15	34.63	33.83	.2865	24.84	24.530	23.91	.1483	46
75	20.75	18.76	16.90	.9325	35.07	34.60	33.96	.2472	25.04	24.785	24.37	.1340	46
100	19.77	18.15	16.88	.7637	35.08	34.62	34.05	.2221	25.18	24.958	24.75	.0939	46
125	18.94	17.68	16.10	.7097	35.01	34.60	34.14	.1981	25.20	25.058	24.93	.0738	46
150	18.59	16.81	14.59	.9791	34.97	34.51	33.98	.2214	25.37	25.197	25.00	.0875	46
200	16.35	13.39	10.77	1.2573	34.60	34.09	33.75	.1911	25.88	25.619	25.38	.1349	44
250	13.17	10.86	9.29	.8804	34.24	34.00	33.81	.0874	26.27	26.040	25.79	.1145	44
300	10.79	9.15	8.16	.5826	34.08	34.00	33.89	.0382	26.53	26.325	26.08	.0903	41
400	8.05	7.17	6.61	.3633	34.28	34.04	33.97	.0422	26.78	26.659	26.49	.0558	41
500	6.72	5.96	5.65	.3022	34.41	34.12	34.00	.0770	27.05	26.879	26.76	.0518	39
600	5.83	5.29	4.90	.2918	34.46	34.23	34.09	.0721	27.20	27.048	26.98	.0437	34
700	5.35	4.85	4.53	.2496	34.50	34.32	34.21	.0600	27.30	27.172	27.12	.0428	25
800	4.92	4.48	4.20	.2070	34.50	34.39	34.28	.0450	27.36	27.267	27.21	.0344	25
900	4.53	4.16	3.82	.1824	34.50	34.44	34.34	.0336	27.40	27.341	27.28	.0292	23
1000	4.10	3.86	3.49	.1591	34.51	34.48	34.45	.0185	27.46	27.408	27.37	.0215	13
1100	3.83	3.63	3.21	.1581	34.54	34.51	34.50	.0144	27.52	27.456	27.43	.0254	11
1200	3.58	3.45	3.37	.0718	34.59	34.53	34.51	.0288	27.53	27.493	27.48	.0189	7
1300	3.37	3.25	3.16	.0916	34.56	34.54	34.52	.0158	27.54	27.516	27.50	.0152	5
1400	3.16	3.03	2.97	.0862	34.58	34.57	34.55	.0129	27.57	27.555	27.54	.0129	4
1500	2.95	2.85	2.76	.0829	34.60	34.59	34.57	.0129	27.61	27.587	27.57	.0171	4
1750	2.48	2.45	2.43	.0222	34.62	34.61	34.58	.0173	27.65	27.640	27.62	.0141	4
2000	2.14	2.12	2.09	.0216	34.63	34.62	34.61	.0115	27.68	27.675	27.67	.0058	4
2500	1.73	1.73	1.73	.0000	34.64	34.64	34.64	.0000	27.73	27.730	27.73	.0000	2
3000	1.53	1.53	1.53	.0000	34.66	34.66	34.66	.0000	27.75	27.750	27.75	.0000	1
4000	1.50	1.50	1.50	.0000	34.68	34.68	34.68	.0000	27.77	27.770	27.77	.0000	1

AREA FIFTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	22.48	19.90	17.41	1.5991	35.00	34.73	33.75	.2945	25.04	24.506	24.00	.3081	22
10	22.50	19.79	16.47	1.5616	35.00	34.73	33.73	.3009	25.10	24.615	24.00	.2965	22
20	22.08	19.67	16.95	1.4651	35.00	34.73	33.73	.3028	25.10	24.659	24.10	.2677	22
30	21.67	19.47	16.90	1.3976	35.03	34.73	33.76	.3032	25.11	24.699	24.23	.2318	22
50	20.90	18.99	16.75	1.1586	35.03	34.70	33.73	.3037	25.13	24.806	24.46	.1763	22
75	20.15	18.81	16.71	.9662	35.06	34.75	33.96	.2549	25.25	24.869	24.66	.1529	22
100	19.66	18.52	16.75	.7756	34.98	34.76	34.31	.1873	25.19	24.920	24.77	.1181	22
125	19.06	17.91	16.25	.7499	34.89	34.68	34.34	.1469	25.26	25.065	24.84	.1100	22
150	18.26	16.91	14.82	1.0137	34.77	34.54	34.13	.1863	25.44	25.191	24.96	.1233	22
200	16.22	13.83	11.01	1.1269	34.57	34.17	33.67	.2075	26.40	25.592	25.34	.1292	22
250	12.84	11.37	9.27	.9126	34.28	34.07	33.80	.1134	26.16	26.000	25.83	.0906	20
300	10.69	9.58	8.38	.6366	34.17	34.03	33.93	.0653	26.39	26.283	26.17	.0686	20
400	9.84	7.43	6.78	.6169	34.26	34.04	33.99	.0574	26.68	26.622	26.41	.0607	20
500	7.26	6.19	5.47	.3987	34.23	34.12	34.01	.0577	26.91	26.859	26.76	.0371	20
600	5.82	5.34	4.83	.2662	34.30	34.21	34.05	.0403	27.07	27.025	26.90	.0360	18
700	5.37	4.91	4.62	.2169	34.36	34.31	34.27	.0242	27.18	27.159	27.12	.0163	16
800	4.96	4.54	4.30	.1697	34.41	34.38	34.34	.0183	27.27	27.259	27.21	.0159	16
900	4.59	4.24	4.05	.1364	34.45	34.43	34.41	.0132	27.35	27.331	27.29	.0141	16
1000	4.03	3.93	3.79	.0941	34.50	34.47	34.45	.0180	27.40	27.391	27.37	.0121	7
1100	3.61	3.57	3.54	.0476	34.50	34.50	34.50	.0000	27.44	27.440	27.44	.0000	2
1200	3.31	3.31	3.31	.0000	34.51	34.51	34.51	.0000	27.48	27.460	27.46	.0000	1
1300	3.13	3.13	3.13	.0000	34.53	34.53	34.53	.0000	27.52	27.520	27.52	.0000	1
1400	2.95	2.95	2.95	.0000	34.54	34.54	34.54	.0000	27.54	27.540	27.54	.0000	1
1500	2.79	2.79	2.79	.0000	34.56	34.56	34.56	.0000	27.57	27.570	27.57	.0000	1
1750	2.44	2.44	2.44	.0000	34.59	34.59	34.59	.0000	27.63	27.630	27.63	.0000	1
2000	2.15	2.15	2.15	.0000	34.61	34.61	34.61	.0000	27.67	27.670	27.67	.0000	1
2500	1.78	1.78	1.78	.0000	34.64	34.64	34.64	.0000	27.73	27.730	27.73	.0000	1
3000	1.56	1.56	1.56	.0000	34.66	34.66	34.66	.0000	27.75	27.750	27.75	.0000	1
4000	1.50	1.50	1.50	.0000	34.69	34.69	34.69	.0000	27.78	27.780	27.78	.0000	1

AREA FIFTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	22.83	20.77	17.96	1.1341	35.16	34.67	33.94	.3581	24.92	24.318	23.60	.3491	23
10	22.80	20.72	17.61	1.1336	35.16	34.68	33.93	.3550	24.93	24.334	23.63	.3367	23
20	22.81	20.72	16.15	1.3102	35.16	34.70	33.93	.3437	24.94	24.350	23.68	.3267	23
30	22.82	20.69	16.19	1.2978	35.16	34.71	33.91	.3398	24.94	24.370	23.77	.3127	23
50	22.78	20.07	17.78	1.2934	35.14	34.68	33.80	.3449	24.95	24.512	24.10	.2179	23
75	21.19	19.07	16.78	1.0979	35.05	34.64	33.86	.3282	24.95	24.739	24.39	.1279	23
100	19.85	18.52	16.54	.6583	35.03	34.66	33.94	.2789	25.08	24.897	24.58	.1129	23
125	19.53	17.65	15.36	1.0516	35.02	34.58	33.88	.3089	25.18	25.043	24.83	.0948	23
150	18.67	16.53	13.65	1.4420	35.00	34.46	33.83	.3462	25.40	25.219	25.03	.0996	23
200	15.66	13.25	10.62	1.5901	34.94	34.10	33.80	.2368	25.96	25.648	25.41	.1402	23
250	12.70	10.95	9.19	1.0821	34.19	34.01	33.81	.1075	26.28	26.026	25.83	.1176	23
300	10.37	9.31	8.05	.7076	34.07	34.00	33.95	.0296	26.51	26.302	26.14	.0994	23
400	8.13	7.20	6.53	.4176	34.11	34.03	33.96	.0364	26.78	26.644	26.54	.0641	23
500	6.75	5.85	5.47	.2518	34.17	34.08	34.00	.0476	26.97	26.862	26.77	.0447	23
600	5.76	5.13	4.91	.1834	34.26	34.19	34.11	.0423	27.10	27.035	26.94	.0338	22
700	5.25	4.83	4.51	.1836	34.33	34.28	34.23	.0359	27.19	27.141	27.09	.0307	10
800	4.78	4.52	4.40	.1186	34.39	34.36	34.30	.0292	27.27	27.239	27.21	.0183	9
900	4.36	4.23	4.08	.0941	34.44	34.43	34.40	.0158	27.34	27.325	27.29	.0169	8
1000	4.06	4.04	4.02	.0263	34.48	34.46	34.45	.0212	27.39	27.375	27.36	.0212	2

Figure C.15.

AREA SIXTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.14	23.26	21.07	.8595	36.32	34.47	33.84	.3521	24.73	23.423	22.47	.4811	134
10	26.14	23.24	21.04	.8662	35.33	34.67	33.83	.3512	24.73	23.430	22.47	.4796	134
20	25.14	23.20	21.04	[illegible]	[illegible]	34.70	33.84	.3460	24.73	23.442	22.47	.4741	134
30	25.14	23.17	21.03	.8471	35.34	34.73	33.94	.3424	24.73	23.499	22.47	.4706	134
50	25.14	23.08	20.93	.8545	35.37	34.79	34.00	.3491	24.73	23.764	22.47	.4705	134
75	25.04	22.89	20.72	.8807	35.37	34.92	34.00	.2987	24.76	23.920	22.73	.4379	134
100	23.71	22.18	19.29	.8743	35.37	35.02	34.41	.2205	24.90	24.208	23.32	.3299	134
125	23.17	20.98	17.10	1.0087	35.90	35.05	34.43	.1743	25.20	24.558	23.88	.2551	134
150	22.92	19.43	14.23	1.2556	35.34	34.89	34.34	.1956	25.65	24.840	24.05	.2427	134
200	20.23	16.80	11.41	2.1748	35.29	34.67	34.18	.2622	26.08	25.376	24.78	.3018	134
250	17.71	13.21	9.42	1.8998	35.26	34.34	34.11	.1445	26.48	25.854	25.23	.2994	134
300	16.00	10.97	8.39	1.2706	34.88	34.29	34.04	.1364	26.67	26.197	25.88	.2403	134
400	10.19	8.41	6.44	.7669	34.67	34.21	34.00	.1482	26.88	26.404	26.25	.1619	134
500	8.80	6.64	5.61	.5587	34.63	34.29	34.01	.1495	27.04	26.854	26.41	.1072	134
600	7.54	5.90	4.94	.5113	34.58	34.30	34.06	.1319	27.19	27.032	26.87	.0708	133
700	6.60	5.31	4.63	.4129	34.54	34.38	34.16	.0872	27.26	27.163	27.04	.0475	129
800	5.77	4.88	4.28	.2347	34.62	34.44	34.29	.0571	27.33	27.263	27.18	.0314	128
900	5.25	4.49	4.05	.2748	34.53	34.48	34.38	.0342	27.39	27.334	27.27	.0256	127
1000	4.74	4.17	3.72	.2307	34.53	34.50	34.44	.0188	27.43	27.392	27.32	.0224	121
1100	4.41	3.88	3.43	.1954	34.58	34.52	34.50	.0158	27.48	27.441	27.39	.0218	119
1200	4.07	3.59	3.18	.1704	34.56	34.54	34.51	.0147	27.52	27.485	27.44	.0188	116
1300	3.75	3.35	2.98	.1533	34.59	34.55	34.51	.0134	27.55	27.516	27.48	.0144	109
1400	3.46	3.12	2.83	.1269	34.60	34.57	34.54	.0117	27.59	27.549	27.51	.0148	99
1500	3.19	2.91	2.66	.1144	34.61	34.58	34.56	.0127	27.61	27.577	27.53	.0160	49
1750	2.87	2.49	2.37	.0671	34.61	34.61	34.59	.0093	27.66	27.640	27.62	.0107	8
2000	2.20	2.14	2.03	.0404	34.62	34.63	34.62	.0071	27.70	27.686	27.68	.0074	8
2500	1.84	1.74	1.73	.0484	34.64	34.66	34.66	.0045	27.78	27.734	27.73	.0110	5
3000	1.68	1.60	1.66	.0403	34.66	34.67	34.67	.0050	27.76	27.740	27.76	.0000	4
4000	1.44	1.41	1.39	.0208	34.70	34.68	34.69	.0271	27.79	27.780	27.75	.0200	4

AREA SIXTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.38	26.13	22.63	.7306	35.28	34.84	34.04	.2289	24.20	23.210	22.25	.3310	89
10	26.34	26.10	22.53	.7280	35.28	34.67	34.08	.2260	24.20	23.224	22.28	.3336	89
20	26.13	25.99	22.58	.7211	35.29	34.88	34.20	.2251	24.19	23.270	22.51	.3305	89
30	26.09	25.88	22.62	.7407	35.31	34.90	34.30	.2313	24.23	23.323	22.65	.3401	89
50	26.00	25.39	22.18	.7973	35.38	34.93	34.33	.2462	24.36	23.487	22.45	.3683	89
75	25.51	23.21	21.25	.9760	35.70	34.99	34.51	.2305	24.46	23.679	23.02	.4218	89
100	25.01	22.04	20.44	.7876	35.36	35.04	34.56	.1988	24.86	24.265	23.32	.3178	89
125	22.43	21.02	18.72	.8010	35.32	35.04	34.42	.1846	25.00	24.540	24.11	.2236	89
150	21.47	19.43	15.90	1.1341	35.27	35.04	34.32	.1978	25.40	24.817	24.32	.2069	89
200	20.48	16.98	11.87	1.7900	35.23	34.73	34.13	.2266	26.26	25.310	24.77	.2500	89
250	16.35	13.57	10.09	1.6517	34.91	34.39	34.11	.1813	26.56	25.803	25.13	.2423	89
300	13.92	11.13	8.80	1.1174	34.66	34.23	34.03	.1162	26.71	26.165	25.75	.2156	88
400	10.10	8.47	7.14	.6009	34.63	34.17	34.03	.1478	26.90	26.567	26.28	.1506	86
500	8.55	6.81	5.69	.4835	34.59	34.19	33.98	.1621	27.02	26.825	26.58	.1078	83
600	7.36	5.63	5.05	.4771	34.56	34.27	34.05	.1366	27.23	27.015	26.84	.0718	79
700	6.55	5.26	4.64	.4283	34.55	34.35	34.17	.0994	27.26	27.149	27.03	.0482	73
800	5.83	4.81	4.23	.3544	34.55	34.42	34.28	.0452	27.32	27.254	27.17	.0310	73
900	5.18	4.44	3.91	.2916	34.54	34.46	34.37	.0392	27.38	27.327	27.28	.0226	72
1000	4.64	4.12	3.66	.2508	34.54	34.49	34.42	.0239	27.44	27.387	27.33	.0247	69
1100	4.27	3.82	3.44	.2055	34.55	34.51	34.44	.0205	27.48	27.437	27.37	.0240	60
1200	4.00	3.66	3.23	.1723	34.56	34.53	34.43	.0211	27.52	27.478	27.40	.0243	55
1300	3.73	3.32	3.09	.1504	34.58	34.58	34.52	.0134	27.54	27.513	27.48	.0177	47
1400	3.62	3.08	2.90	.1262	34.61	34.56	34.54	.0136	27.60	27.547	27.50	.0195	43
1500	3.07	2.84	2.72	.1113	34.63	34.58	34.54	.0204	27.63	27.577	27.55	.0221	19
1750	2.90	2.50	2.22	.1744	34.64	34.60	34.56	.0240	27.67	27.627	27.56	.0324	9
2000	3.05	2.25	2.00	.2323	34.74	34.64	34.61	.0506	27.71	27.682	27.66	.0198	8
2500	1.83	1.76	1.69	.0570	34.67	34.65	34.62	.0160	27.75	27.730	27.70	.0153	7
3000	1.76	1.60	1.62	.0848	34.69	34.66	34.63	.0197	27.78	27.752	27.71	.0232	6
4000	1.88	1.47	1.43	.0443	34.68	34.67	34.65	.0130	27.78	27.772	27.78	.0130	5
5000	1.48	1.44	1.43	.0141	34.69	34.67	34.66	.0212	27.78	27.770	27.76	.0141	2

AREA SIXTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.10	23.87	21.28	.8783	35.26	34.70	34.08	.2666	24.61	23.462	22.69	.4001	166
10	26.00	23.84	21.29	.8782	35.26	34.70	34.07	.2542	24.60	23.477	22.63	.3987	164
20	26.01	23.72	21.29	.8830	35.28	34.73	34.19	.2539	24.60	23.538	22.68	.3946	164
30	26.02	23.58	21.28	.8483	35.32	34.78	34.18	.2575	24.61	23.597	22.73	.4019	164
50	26.03	23.24	20.73	.9298	35.30	34.82	34.16	.2743	24.72	23.742	22.88	.4441	164
75	26.05	22.65	20.39	.9449	35.33	34.92	34.17	.2840	24.91	23.986	22.85	.4561	164
100	24.51	21.46	19.70	.9461	35.30	35.02	34.26	.1927	25.00	24.264	23.12	.3832	164
125	23.27	21.01	17.40	1.0187	35.39	35.08	34.53	.1909	25.16	24.559	23.65	.2975	164
150	22.39	19.03	16.30	1.2529	35.30	35.01	34.37	.1599	25.46	24.823	24.10	.2422	164
200	20.40	16.72	11.19	1.7413	35.16	34.69	34.17	.2358	26.12	25.337	24.62	.2744	164
250	17.01	13.38	9.26	1.7561	34.90	34.34	34.10	.1509	26.51	25.832	25.33	.2448	163
300	14.36	11.07	8.59	1.1627	34.57	34.23	34.04	.1087	26.68	26.177	25.68	.2222	162
400	10.00	8.63	7.14	.8841	34.61	34.19	33.93	.1514	26.90	26.676	26.28	.1566	162
500	7.97	6.88	5.78	.6879	34.58	34.21	33.90	.1649	27.03	26.834	26.67	.1112	161
600	7.21	5.89	4.98	.4760	34.58	34.28	34.04	.1378	27.16	27.016	26.85	.0725	161
700	6.53	5.33	4.93	.4140	34.53	34.37	34.14	.0914	27.26	27.152	27.01	.0466	161
800	5.93	4.86	4.15	.3477	34.52	34.43	34.21	.0424	27.36	27.255	27.08	.0346	162
900	5.42	4.60	3.98	.2820	34.53	34.47	34.26	.0424	27.41	27.327	27.17	.0299	151
1000	4.98	4.18	3.76	.2274	34.59	34.50	34.30	.0319	27.46	27.386	27.23	.0294	143
1100	4.46	3.89	3.53	.1850	34.56	34.52	34.30	.0309	27.48	27.433	27.25	.0280	132
1200	4.06	3.61	3.29	.1568	34.57	34.53	34.30	.0292	27.52	27.479	27.24	.0284	127
1300	3.78	3.36	3.08	.1402	34.59	34.55	34.31	.0293	27.56	27.513	27.32	.0263	121
1400	3.55	3.13	2.88	.1398	34.60	34.56	34.33	.0292	27.59	27.543	27.35	.0274	114
1500	3.36	2.91	2.71	.1274	34.60	34.67	34.34	.0490	27.61	27.566	27.38	.0392	106
1750	2.80	2.48	2.30	.0716	34.63	34.57	34.36	.0770	27.66	27.607	27.44	.0436	38
2000	2.20	2.13	2.04	.0408	34.65	34.62	34.59	.0242	27.71	27.680	27.65	.0200	11
2500	1.83	1.77	1.68	.0590	34.68	34.65	34.62	.0209	27.76	27.737	27.71	.0141	9
3000	1.66	1.61	1.58	.0346	34.69	34.67	34.64	.0159	27.77	27.754	27.73	.0113	9
4000	1.50	1.46	1.43	.0282	34.70	34.68	34.66	.0166	27.79	27.776	27.75	.0161	9
5000	1.47	1.44	1.41	.0300	34.70	34.69	34.68	.0116	27.79	27.780	27.77	.0100	3

AREA SIXTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	26.49	24.44	23.12	.8284	36.18	34.72	33.80	.4578	24.07	23.162	22.08	.4809	74
10	26.66	24.93	23.10	.8200	36.16	34.72	33.82	.4558	24.07	23.168	22.13	.4807	74
20	26.44	24.80	23.01	.8043	36.09	34.77	33.98	.4073	24.12	23.246	22.33	.4487	74
30	26.42	24.66	22.61	.8116	36.02	34.82	34.01	.3412	24.16	23.326	22.44	.4224	74
50	26.40	24.33	21.87	.9149	35.92	34.91	34.03	.2920	24.45	23.487	22.51	.4022	74
75	25.57	23.37	19.54	1.0871	35.84	35.00	34.51	.2283	24.77	23.839	23.02	.3814	74
100	25.48	21.99	15.66	1.3437	35.86	35.06	34.40	.2119	25.38	24.271	23.12	.3686	74
125	24.02	20.79	13.18	1.8557	35.88	35.06	34.30	.2282	25.83	24.603	23.62	.3238	74
150	23.71	19.48	11.80	1.9337	35.90	34.99	34.30	.2736	26.09	24.887	24.13	.3192	74
200	21.44	16.48	10.10	2.4492	35.71	34.69	34.19	.2866	26.44	25.373	24.75	.3616	74
250	19.17	13.19	9.13	2.0673	35.52	34.39	34.12	.2249	26.62	25.878	25.25	.3308	73
300	16.87	11.10	8.37	1.4623	35.30	34.29	34.05	.2227	26.71	26.209	25.78	.2568	72
400	12.47	8.66	7.00	.9190	34.89	34.23	34.02	.2085	26.89	26.599	26.33	.1646	71
500	9.56	6.93	6.73	.7097	34.59	34.25	34.01	.1849	27.03	26.850	26.67	.1077	70
600	7.38	5.92	5.04	.6026	34.54	34.30	34.04	.1435	27.16	27.028	26.88	.0718	70
700	6.62	5.36	4.62	.4871	34.52	34.38	34.21	.0891	27.26	27.162	27.02	.0526	66
800	5.87	4.88	4.23	.3886	34.51	34.44	34.24	.0598	27.34	27.260	27.09	.0466	64
900	5.33	4.50	4.00	.3078	34.54	34.47	34.31	.0418	27.40	27.331	27.18	.0404	63
1000	4.83	4.17	3.70	.2553	34.54	34.50	34.38	.0293	27.44	27.390	27.28	.0348	58
1100	4.39	3.86	3.48	.2189	34.56	34.52	34.42	.0275	27.48	27.428	27.33	.0336	56
1200	4.04	3.58	3.18	.1817	34.58	34.54	34.46	.0209	27.52	27.488	27.40	.0244	51
1300	3.72	3.29	2.90	.1578	34.59	34.56	34.49	.0146	27.57	27.525	27.48	.0182	44
1400	3.44	3.04	2.71	.1411	34.60	34.57	34.62	.0123	27.61	27.554	27.51	.0170	44
1500	3.02	2.83	2.66	.1287	34.59	34.60	34.53	.0147	27.62	27.588	27.57	.0126	16
1750	2.55	2.47	2.31	.0909	34.62	34.61	34.59	.0098	27.65	27.651	27.63	.0090	7
2000	2.19	2.12	2.06	.0416	34.60	34.63	34.60	.0183	27.71	27.686	27.67	.0151	7
2500	1.86	1.83	1.79	.0239	34.67	34.65	34.61	.0223	27.76	27.728	27.69	.0204	6
3000	1.70	1.69	1.60	.0346	34.68	34.67	34.64	.0147	27.77	27.755	27.73	.0138	6
4000	1.52	1.48	1.44	.0409	34.69	34.68	34.68	.0058	27.78	27.777	27.77	.0058	3
5000	1.34	1.39	1.39	.0000	34.70	34.70	34.70	.0000	27.80	27.800	27.80	.0000	1

Figure C.16.

AREA SEVENTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.00	26.19	24.23	.4713	35.59	34.60	34.30	.3013	23.43	22.687	22.38	.2799	17
10	26.96	26.01	24.27	.4712	35.59	34.88	34.46	.3776	23.42	22.948	22.69	.3270	6
20	26.99	26.00	24.26	.4713	35.50	34.87	34.44	.3763	23.42	22.948	22.69	.3280	6
30	26.92	25.99	24.25	.4736	35.50	34.87	34.45	.3781	23.42	22.950	22.50	.3263	6
50	26.91	25.80	23.63	1.2414	35.69	34.87	34.47	.4079	23.48	23.010	22.57	.3755	6
75	26.99	23.80	18.00	3.4936	35.84	35.01	34.37	.7743	24.75	23.740	22.62	1.0044	6
100	24.40	20.27	13.90	4.4504	35.73	35.15	34.50	.8075	25.91	24.732	23.23	1.1550	6
125	19.50	16.02	12.17	3.1296	35.64	35.08	34.61	.7774	26.31	25.770	25.15	.6228	6
150	17.00	13.19	10.90	2.2016	35.25	35.00	34.67	.6209	26.57	26.340	26.16	.1703	6
200	13.50	11.55	10.09	1.4766	35.44	34.91	34.68	.3494	26.80	26.407	26.27	.1404	6
250	12.51	10.65	9.17	1.1119	35.30	34.84	34.60	.2391	26.94	26.723	26.40	.1827	6
300	11.50	9.99	9.33	.8704	35.14	34.80	34.67	.1832	27.01	26.807	26.63	.1469	6
400	9.50	8.77	8.39	.4354	34.87	34.71	34.61	.1097	27.12	26.943	26.78	.1221	6
500	7.76	7.47	7.14	.2024	34.79	34.67	34.56	.0955	27.19	27.104	27.03	.0677	5
600	6.38	6.38	6.38	.0000	34.64	34.64	34.64	.0000	27.25	27.250	27.25	.0000	1
700	5.87	5.87	5.87	.0000	34.65	34.65	34.66	.0000	27.31	27.310	27.31	.0000	1
800	5.40	5.40	5.40	.0000	34.69	34.69	34.69	.0000	27.40	27.400	27.40	.0000	1
900	5.00	5.00	5.00	.0000	34.71	34.71	34.71	.0000	27.48	27.480	27.48	.0000	1
1000	4.96	4.96	4.96	.0000	34.73	34.73	34.73	.0000	27.48	27.480	27.48	.0000	1
1100	4.98	4.98	4.98	.0000	34.75	34.75	34.76	.0000	27.60	27.600	27.60	.0000	1

AREA SEVENTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.88	27.19	26.11	.4780	35.00	34.06	32.54	.6425	23.32	21.768	20.75	.6097	21
10	27.90	27.10	26.09	.4381	35.00	34.06	32.56	.6413	23.34	21.967	20.75	.6119	21
20	27.90	27.18	26.00	.4611	34.98	34.08	32.79	.6229	23.38	21.992	20.91	.6033	21
30	27.90	26.53	24.83	1.0826	34.98	34.19	33.21	.6327	23.38	22.242	21.20	.6524	21
50	27.07	24.85	16.03	3.4303	35.02	34.44	33.42	.3584	25.25	23.033	21.60	1.1391	21
75	27.66	20.90	13.93	4.0798	35.02	34.69	34.25	.2225	26.05	24.168	22.31	1.2735	21
100	26.30	17.87	11.21	5.2673	35.00	34.75	34.48	.1638	26.48	25.001	22.93	1.2765	21
125	26.10	15.61	11.19	4.6209	35.05	34.77	34.37	.1402	26.59	25.686	22.96	1.0705	21
150	23.38	13.48	10.82	3.0619	34.92	34.77	34.59	.0987	26.59	26.096	23.79	.7054	21
200	13.58	11.27	10.34	.7201	34.89	34.76	34.61	.0733	26.67	26.551	26.00	.1491	20
250	10.89	10.48	9.92	.3361	34.83	34.75	34.63	.0595	26.75	26.689	26.59	.0500	20
300	10.40	9.95	9.60	.2974	34.79	34.72	34.63	.0508	26.82	26.759	26.71	.0371	20
400	9.61	9.07	8.50	.2806	34.77	34.68	34.61	.0472	26.94	26.870	26.81	.0348	19
500	8.97	7.99	7.47	.2727	34.69	34.62	34.56	.0362	27.09	26.992	26.90	.0520	18
600	7.51	6.93	6.58	.2820	34.63	34.58	34.51	.0349	27.16	27.114	27.00	.0543	17
700	6.61	6.07	5.83	.2281	34.61	34.57	34.51	.0330	27.28	27.217	27.12	.0492	17
800	5.83	5.41	5.19	.1891	34.61	34.57	34.50	.0361	27.36	27.305	27.23	.0438	16
900	5.10	4.88	4.69	.1786	34.61	34.57	34.52	.0304	27.42	27.368	27.30	.0429	16
1000	4.67	4.55	4.22	.1808	34.62	34.57	34.53	.0328	27.48	27.419	27.36	.0430	14
1100	4.34	4.07	3.85	.1818	34.63	34.58	34.53	.0359	27.53	27.465	27.40	.0465	14
1200	4.01	3.70	3.52	.1717	34.64	34.59	34.53	.0397	27.57	27.505	27.44	.0459	14
1300	3.70	3.48	3.26	.1616	34.68	34.60	34.54	.0398	27.59	27.541	27.48	.0450	12
1400	3.41	3.23	3.09	.1461	34.66	34.61	34.56	.0403	27.62	27.573	27.51	.0444	12
1500	3.20	3.01	2.83	.1267	34.68	34.62	34.55	.0438	27.66	27.601	27.53	.0432	12
1750	2.70	2.56	2.52	.0865	34.69	34.64	34.58	.0398	27.70	27.654	27.60	.0373	12
2000	2.30	2.19	2.11	.0634	34.69	34.66	34.60	.0360	27.73	27.703	27.65	.0340	10
2500	1.87	1.88	1.83	.0186	34.75	34.69	34.62	.0420	27.80	27.767	27.70	.0333	6
3000	1.72	1.72	1.72	.0000	34.64	34.64	34.64	.0000	27.73	27.730	27.73	.0000	1
4000	1.30	1.30	1.30	.0000	34.64	34.64	34.64	.0000	27.78	27.780	27.78	.0000	1

AREA SEVENTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.38	27.64	26.86	.4096	34.96	34.36	33.07	.4102	22.68	22.084	21.10	.3442	26
10	28.29	27.69	26.89	.3955	34.96	34.39	33.69	.3400	22.71	22.098	21.44	.3118	26
20	28.24	27.54	26.75	.4196	34.97	34.42	33.70	.3406	22.79	22.128	21.41	.3280	26
30	28.23	27.17	24.31	.8276	35.01	34.48	33.76	.3256	23.20	22.296	21.46	.3957	26
50	27.88	24.60	14.60	4.2700	35.01	34.64	33.83	.2390	25.72	23.117	21.88	1.1488	26
75	27.59	20.93	12.82	4.0566	35.06	34.72	33.84	.2339	26.21	24.218	21.90	1.2655	26
100	23.71	16.11	11.09	3.6634	34.96	34.79	34.54	.1126	26.45	25.400	23.82	.8264	26
125	18.11	13.56	11.40	2.0809	34.94	34.78	34.62	.0897	26.58	26.074	25.01	.4429	25
150	14.22	12.21	10.92	1.0944	34.94	34.73	34.62	.0899	26.62	26.353	25.89	.2248	25
200	12.34	10.87	10.04	.6226	34.70	34.73	34.62	.0725	26.76	26.604	26.44	.0864	23
250	11.26	10.19	9.61	.6058	34.81	34.72	34.63	.0578	26.83	26.719	26.58	.0679	18
300	10.70	9.77	9.23	.4162	34.77	34.70	34.63	.0366	26.86	26.775	26.67	.0526	18
400	9.61	8.93	8.53	.2855	34.68	34.65	34.61	.0182	26.99	26.880	26.78	.0400	16
500	8.71	8.06	7.59	.3992	34.66	34.60	34.56	.0302	27.02	26.969	26.91	.0402	8
600	7.22	7.00	6.65	.1892	34.59	34.57	34.54	.0199	27.14	27.096	27.07	.0223	7
700	6.28	6.11	5.88	.1483	34.56	34.54	34.52	.0177	27.23	27.194	27.17	.0215	7
800	5.63	5.45	5.18	.1641	34.55	34.54	34.53	.0090	27.30	27.276	27.25	.0190	7
900	5.00	4.96	4.83	.0850	34.58	34.55	34.52	.0198	27.37	27.339	27.32	.0195	7
1000	4.60	4.46	4.41	.0879	34.58	34.58	34.50	.0261	27.43	27.387	27.33	.0215	7
1100	4.30	4.19	4.03	.0911	34.58	34.56	34.53	.0190	27.45	27.433	27.41	.0163	4
1200	3.94	3.86	3.71	.0860	34.59	34.57	34.54	.0183	27.50	27.483	27.46	.0151	4
1300	3.69	3.58	3.47	.0794	34.60	34.57	34.56	.0160	27.53	27.510	27.50	.0126	4
1400	3.47	3.33	3.25	.0807	34.60	34.58	34.56	.0147	27.56	27.538	27.51	.0194	4
1500	3.25	3.11	3.03	.0787	34.61	34.59	34.57	.0147	27.58	27.567	27.54	.0175	4
1750	2.61	2.60	2.58	.0163	34.62	34.61	34.61	.0058	27.63	27.630	27.63	.0000	3
2000	2.28	2.24	2.19	.0458	34.64	34.63	34.62	.0100	27.69	27.680	27.67	.0100	3
2500	1.91	1.89	1.87	.0283	34.68	34.63	34.62	.0212	27.73	27.710	27.69	.0283	2
3000	1.70	1.69	1.69	.0071	34.60	34.67	34.66	.0141	27.76	27.766	27.75	.0071	2

AREA SEVENTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.01	26.60	24.37	1.1363	35.56	34.26	33.11	.6765	23.32	22.303	21.16	.6094	28
10	27.80	26.40	24.20	1.1190	35.52	34.29	33.20	.5613	23.34	22.304	21.40	.6379	28
20	27.65	25.89	22.53	1.4296	35.56	34.30	33.30	.5096	23.65	22.614	21.52	.6150	28
30	27.64	25.11	19.02	1.9703	35.59	34.47	33.50	.4201	24.69	22.909	21.86	.6273	28
50	27.32	23.06	13.93	3.2394	35.64	34.61	34.27	.3138	26.48	23.581	22.08	.9717	28
75	26.66	20.64	11.93	4.0099	35.66	34.73	34.46	.2463	26.39	24.325	22.56	1.2062	28
100	26.55	18.00	11.16	3.9602	35.69	34.77	34.49	.2465	26.50	25.031	23.51	1.0539	28
125	23.54	16.78	10.96	3.4459	35.67	34.79	34.38	.2405	26.50	25.565	23.79	.8405	28
150	22.43	15.06	10.49	3.3273	35.67	34.79	34.20	.2379	26.60	25.973	24.01	.6432	28
200	19.82	12.11	10.33	2.2827	35.56	34.76	34.41	.1890	26.67	26.314	24.70	.3977	28
250	14.90	11.06	9.77	1.2936	35.16	34.73	34.40	.1348	26.73	26.558	26.09	.1742	28
300	12.78	10.30	9.12	.9771	34.92	34.68	34.38	.1028	26.81	26.669	26.49	.0921	28
400	10.56	9.20	8.06	.5424	34.76	34.64	34.44	.0432	26.92	26.819	26.67	.0532	28
500	9.00	8.07	7.26	.3704	34.67	34.58	34.44	.0599	27.07	26.947	26.85	.0508	28
600	7.65	7.08	6.45	.2909	34.64	34.54	34.37	.0511	27.15	27.073	27.00	.0408	28
700	6.63	6.13	6.61	.1997	34.60	34.51	34.43	.0395	27.26	27.176	27.11	.0391	27
800	6.00	5.65	5.17	.2142	34.57	34.51	34.41	.0429	27.33	27.267	27.18	.0385	26
900	6.13	5.33	4.54	.1746	34.57	34.51	34.43	.0427	27.38	27.323	27.23	.0404	23
1000	4.60	4.39	4.14	.1376	34.61	34.51	34.43	.0446	27.44	27.376	27.30	.0449	15
1100	4.10	4.02	3.87	.1004	34.60	34.53	34.45	.0369	27.48	27.431	27.35	.0388	12
1200	3.77	3.71	3.67	.0624	34.60	34.57	34.51	.0332	27.52	27.480	27.44	.0303	5
1300	3.82	3.58	3.37	.0660	34.60	34.57	34.51	.0366	27.55	27.522	27.48	.0277	5
1400	3.27	3.21	3.09	.0723	34.60	34.56	34.53	.0303	27.58	27.550	27.51	.0266	5
1500	3.03	2.97	2.87	.0663	34.60	34.57	34.53	.0276	27.61	27.564	27.55	.0230	5
1750	2.62	2.57	2.52	.0434	34.65	34.59	34.55	.0359	27.68	27.632	27.57	.0249	5
2000	2.30	2.24	2.15	.0617	34.67	34.62	34.57	.0332	27.70	27.670	27.64	.0249	5
2500	1.89	1.86	1.80	.0132	34.65	34.63	34.61	.0130	27.73	27.725	27.71	.0089	5
3000	1.72	1.72	1.68	.0151	34.68	34.67	34.63	.0237	27.77	27.750	27.73	.0198	5
4000	1.81	1.74	1.41	.0983	34.70	34.67	34.64	.0299	27.80	27.772	27.74	.0275	5

Figure C.17.

AREA EIGHTEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	20.83	16.78	13.69	1.3116	34.79	33.79	33.20	.3646	24.98	24.496	24.18	.1705	123
10	20.69	16.77	14.00	1.3069	34.64	33.78	33.20	.3597	25.06	24.493	24.18	.1718	122
20	20.43	16.75	13.89	1.3433	34.46	33.80	33.18	.3584	25.01	24.467	24.18	.1720	120
30	20.63	16.73	13.66	1.3736	34.83	33.80	33.18	.3674	25.03	24.488	24.18	.1730	120
50	20.65	16.69	13.90	1.4387	34.82	33.82	33.18	.3625	25.06	24.485	24.20	.1762	120
75	20.93	16.89	12.92	1.6706	34.74	33.82	33.17	.3712	25.18	24.721	24.23	.1822	120
100	20.93	15.66	10.62	1.9996	34.78	33.79	33.04	.3765	25.55	24.896	24.40	.2090	120
125	18.76	14.39	9.86	2.0738	34.85	33.77	33.16	.3359	25.62	25.163	24.66	.2397	120
150	17.04	12.88	9.28	1.9011	34.91	33.75	33.26	.2991	26.06	25.499	24.90	.2564	120
200	13.91	10.29	8.45	1.0952	34.21	33.80	33.52	.1295	26.38	25.988	25.52	.1988	119
250	10.83	8.96	7.86	.6081	34.33	33.94	33.73	.1076	26.55	26.328	25.98	.1268	118
300	9.56	8.10	7.13	.5149	34.46	34.06	33.88	.1048	26.70	26.538	26.29	.0822	118
400	8.69	6.90	6.30	.4458	34.50	34.15	33.98	.0999	26.98	26.789	26.63	.0592	115
500	7.46	6.06	5.35	.3424	34.50	34.24	34.04	.0600	27.16	26.940	26.82	.0481	110
600	6.39	5.82	4.82	.3096	34.48	34.31	34.18	.0452	27.23	27.066	27.00	.0420	72
700	5.70	5.09	4.60	.2349	34.50	34.37	34.27	.0562	27.27	27.188	27.09	.0411	50
800	5.13	4.67	4.20	.1805	34.52	34.42	34.30	.0525	27.35	27.270	27.16	.0394	48
900	4.64	4.32	3.94	.1961	34.53	34.46	34.32	.0479	27.41	27.339	27.23	.0394	47
1000	4.23	4.02	3.77	.1092	34.56	34.48	34.36	.0470	27.46	27.391	27.28	.0403	40
1100	3.92	3.74	3.64	.0836	34.57	34.51	34.36	.0393	27.50	27.439	27.32	.0336	37
1200	3.68	3.50	3.26	.0843	34.58	34.53	34.37	.0458	27.53	27.481	27.38	.0379	22
1300	3.41	3.29	3.15	.0711	34.62	34.57	34.52	.0276	27.58	27.521	27.50	.0247	10
1400	3.21	3.12	3.01	.0491	34.61	34.57	34.55	.0198	27.59	27.552	27.53	.0191	8
1500	3.01	2.90	2.76	.0929	34.59	34.58	34.56	.0207	27.63	27.582	27.55	.0225	8
1750	2.53	2.46	2.39	.0457	34.65	34.61	34.58	.0220	27.67	27.642	27.61	.0183	8
2000	2.16	2.12	2.11	.0180	34.67	34.63	34.60	.0249	27.71	27.686	27.66	.0181	7
2500	1.79	1.78	1.78	.0058	34.65	34.65	34.65	.0000	27.73	27.730	27.73	.0000	3
3000	1.63	1.61	1.58	.0269	34.67	34.67	34.66	.0058	27.76	27.753	27.75	.0058	3
4000	1.57	1.57	1.57	.0000	34.67	34.67	34.67	.0000	27.76	27.760	27.76	.0000	1

AREA EIGHTEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	28.00	19.71	16.66	1.6924	34.76	33.83	33.15	.3165	24.52	23.961	21.62	.3431	158
10	27.46	19.60	16.69	1.3743	34.76	33.82	33.18	.3163	24.53	23.999	22.08	.2970	158
20	27.48	19.34	16.42	1.3717	34.75	33.83	33.16	.3178	24.57	24.050	22.17	.2766	158
30	27.48	19.02	16.76	1.3509	34.75	33.84	33.17	.3160	24.73	24.140	22.21	.2538	158
50	27.16	17.88	14.27	1.3876	34.80	33.86	33.20	.3222	25.01	24.436	22.31	.2394	158
75	26.98	16.59	13.09	1.6163	34.71	33.85	33.23	.3236	25.16	24.733	22.37	.2401	158
100	26.80	15.68	12.13	1.7043	34.79	33.86	33.20	.3472	25.36	24.943	22.82	.2231	156
125	23.64	14.49	10.62	1.9666	34.77	33.84	33.26	.3459	25.73	25.182	23.59	.2244	156
150	21.67	12.97	9.38	2.0037	34.86	33.78	33.31	.2905	26.04	25.453	24.16	.2189	156
200	19.52	10.34	8.61	1.3233	34.89	33.82	33.58	.1375	26.50	25.980	24.82	.2183	156
250	18.93	9.06	7.81	1.0174	34.89	33.97	33.78	.1173	26.65	26.316	24.98	.1692	155
300	18.45	8.17	7.21	.9593	34.86	34.07	33.81	.1164	26.86	26.526	25.07	.1627	151
400	14.66	6.91	6.04	.7439	34.62	34.15	33.96	.1033	26.90	26.776	25.77	.1019	146
500	12.05	6.07	5.45	.6196	34.92	34.22	34.06	.0812	27.08	26.956	26.14	.0811	143
600	6.19	5.48	4.88	.2910	34.44	34.29	34.13	.0658	27.18	27.080	26.93	.0398	94
700	5.98	5.01	4.56	.2457	34.50	34.35	34.08	.0642	27.28	27.182	26.93	.0476	82
800	5.06	4.60	4.17	.1974	34.55	34.40	34.12	.0586	27.38	27.269	27.02	.0464	62
900	4.69	4.23	3.91	.1526	34.57	34.44	34.28	.0468	27.44	27.337	27.19	.0398	64
1000	4.13	3.93	3.70	.1127	34.60	34.48	34.33	.0465	27.50	27.394	27.27	.0411	61
1100	3.85	3.67	3.50	.0994	34.59	34.50	34.34	.0408	27.52	27.436	27.30	.0373	47
1200	3.59	3.41	3.29	.0750	34.59	34.54	34.50	.0299	27.54	27.497	27.46	.0222	21
1300	3.31	3.20	3.10	.0610	34.60	34.55	34.51	.0263	27.56	27.529	27.50	.0175	13
1400	3.06	3.00	2.94	.0407	34.61	34.57	34.52	.0239	27.59	27.567	27.52	.0191	12
1500	2.86	2.82	2.77	.0321	34.63	34.57	34.53	.0288	27.63	27.580	27.54	.0240	9
1750	2.42	2.39	2.36	.0201	34.65	34.61	34.57	.0224	27.68	27.651	27.61	.0190	7
2000	2.13	2.10	2.05	.0276	34.68	34.62	34.60	.0259	27.73	27.680	27.66	.0227	8
2500	1.81	1.77	1.72	.0373	34.73	34.64	34.62	.0387	27.78	27.724	27.70	.0270	7
3000	1.66	1.61	1.53	.0626	34.73	34.66	34.63	.0316	27.79	27.754	27.73	.0181	7
4000	1.47	1.47	1.47	.0000	34.67	34.67	34.67	.0000	27.77	27.770	27.77	.0000	1

AREA EIGHTEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	19.95	16.94	14.39	1.0902	34.61	33.75	33.21	.2990	25.03	24.583	24.00	.1832	185
10	19.81	16.87	14.41	1.0739	34.61	33.75	33.14	.2940	25.02	24.593	24.09	.1827	185
20	19.68	16.80	14.41	1.0695	34.61	33.75	33.12	.2956	25.01	24.616	24.20	.1705	182
30	19.45	16.69	14.03	1.0564	34.61	33.76	33.10	.2971	25.08	24.643	24.25	.1627	182
50	18.89	16.39	13.12	1.1391	34.61	33.76	33.10	.3061	25.25	24.712	24.35	.1615	182
75	18.48	15.90	12.08	1.4456	34.61	33.75	33.03	.3451	25.33	24.818	24.37	.1695	181
100	18.31	15.07	11.11	1.7840	34.64	33.73	33.06	.3545	25.54	24.982	24.55	.1971	179
125	17.40	13.72	9.82	1.9087	34.66	33.70	33.11	.3016	25.87	25.242	24.70	.2387	176
150	17.46	12.29	9.13	1.6093	34.50	33.70	33.23	.2388	26.10	25.525	24.91	.2636	178
200	14.36	10.01	8.38	1.0387	34.37	33.81	33.50	.1429	26.43	26.029	25.49	.2016	171
250	11.72	8.90	7.67	.7012	34.49	33.98	33.68	.1231	26.66	26.350	25.96	.1242	170
300	11.09	8.11	6.98	.6237	34.45	34.08	33.84	.1175	26.76	26.549	26.29	.0881	170
400	9.45	6.92	6.97	.5384	34.48	34.16	34.00	.1035	26.93	26.785	26.61	.0694	162
500	7.75	6.11	5.38	.4109	34.45	34.29	34.07	.0779	27.11	26.956	26.85	.0450	158
600	6.59	5.61	4.89	.3369	34.48	34.31	34.17	.0618	27.19	27.083	27.00	.0356	117
700	5.32	5.04	4.56	.2491	34.50	34.34	34.27	.0459	27.28	27.188	27.10	.0222	102
800	5.20	4.63	4.26	.2127	34.53	34.41	34.30	.0399	27.34	27.271	27.16	.0309	100
900	4.31	4.20	3.96	.1690	34.56	34.46	34.31	.0380	27.41	27.337	27.21	.0320	94
1000	4.40	3.98	3.68	.1366	34.59	34.48	34.34	.0377	27.46	27.390	27.27	.0328	86
1100	4.36	3.73	3.63	.1079	34.58	34.49	34.38	.0358	27.50	27.428	27.33	.0306	68
1200	3.78	3.48	3.33	.1004	34.59	34.51	34.46	.0267	27.52	27.475	27.42	.0237	48
1300	3.45	3.24	3.10	.0878	34.57	34.53	34.48	.0183	27.55	27.508	27.46	.0156	28
1400	3.17	3.02	2.90	.0728	34.58	34.55	34.50	.0140	27.57	27.541	27.48	.0160	27
1500	2.98	2.83	2.73	.0599	34.58	34.56	34.50	.0146	27.58	27.571	27.51	.0149	26
1750	2.48	2.40	2.39	.0374	34.61	34.59	34.58	.0060	27.65	27.632	27.62	.0078	21
2000	2.18	2.11	2.06	.0246	34.63	34.61	34.59	.0102	27.69	27.672	27.65	.0093	21
2500	1.80	1.79	1.77	.0100	34.65	34.64	34.62	.0093	27.73	27.724	27.70	.0113	9
3000	1.65	1.61	1.56	.0319	34.67	34.68	34.60	.0224	27.75	27.742	27.70	.0172	9
4000	1.56	1.52	1.50	.0321	34.68	34.67	34.67	.0058	27.77	27.767	27.76	.0058	3

AREA EIGHTEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	23.06	19.42	16.07	1.2721	34.54	33.81	33.12	.3431	24.77	24.019	23.48	.2587	135
10	23.07	19.39	16.09	1.2456	34.55	33.80	33.12	.3178	24.89	24.015	23.62	.2711	116
20	22.98	19.36	15.76	1.2380	34.50	33.81	33.12	.3174	24.89	24.028	23.52	.2659	116
30	22.10	19.28	15.33	1.2261	34.55	33.81	33.11	.3171	24.89	24.059	23.53	.2608	116
50	21.06	18.37	14.36	1.3633	34.79	33.79	33.12	.3339	24.93	24.260	23.68	.2378	115
75	19.73	16.90	11.76	1.6038	34.67	33.73	33.05	.3312	25.46	24.688	24.13	.2248	116
100	18.88	15.17	10.66	1.7906	34.76	33.77	33.01	.3256	25.77	24.964	24.53	.2270	116
125	18.37	13.73	9.65	1.9964	34.70	33.76	33.07	.3156	26.06	25.277	24.69	.2483	116
150	17.62	12.30	8.96	1.9581	34.57	33.74	33.28	.2638	26.27	25.649	25.03	.2576	116
200	13.63	10.01	8.33	1.1637	34.26	33.84	33.39	.1319	26.48	26.052	25.52	.2116	116
250	11.24	8.90	7.66	.7665	34.34	33.94	33.76	.1200	26.61	26.364	25.96	.1408	116
300	9.46	8.11	7.03	.6031	34.38	34.07	33.89	.1155	26.73	26.547	26.27	.1000	116
400	8.16	6.89	6.14	.5017	34.40	34.16	33.96	.1152	26.94	26.787	26.61	.0678	113
500	7.45	6.07	5.33	.4723	34.44	34.29	34.05	.0955	27.11	26.959	26.79	.0624	111
600	6.20	5.60	4.90	.3370	34.48	34.31	34.17	.0763	27.21	27.090	26.97	.0445	78
700	5.58	5.05	4.27	.2957	34.48	34.37	34.26	.0678	27.28	27.189	27.09	.0392	52
800	5.09	4.64	4.20	.2156	34.51	34.41	34.32	.0473	27.36	27.269	27.18	.0363	51
900	4.68	4.29	4.02	.1566	34.55	34.45	34.33	.0420	27.43	27.338	27.23	.0354	47
1000	4.38	3.99	3.73	.1563	34.58	34.48	34.36	.0407	27.50	27.394	27.28	.0380	38
1100	4.33	3.72	3.48	.1533	34.60	34.50	34.40	.0359	27.53	27.440	27.35	.0344	37
1200	3.63	3.46	3.28	.1068	34.55	34.52	34.45	.0269	27.51	27.479	27.41	.0285	21
1300	3.38	3.24	3.09	.0971	34.57	34.53	34.46	.0322	27.63	27.507	27.43	.0290	11
1400	3.13	3.03	2.92	.0789	34.58	34.56	34.48	.0282	27.56	27.541	27.49	.0213	10
1500	2.93	2.89	2.76	.0607	34.58	34.56	34.52	.0193	27.58	27.570	27.53	.0166	10
1750	2.50	2.42	2.36	.0432	34.63	34.59	34.55	.0246	27.66	27.639	27.57	.0184	10
2000	2.17	2.13	2.08	.0320	34.63	34.62	34.57	.0177	27.69	27.675	27.69	.0128	10
2500	1.89	1.80	1.75	.0333	34.66	34.63	34.58	.0283	27.75	27.719	27.67	.0262	9
3000	1.70	1.62	1.59	.0306	34.68	34.65	34.58	.0340	27.77	27.739	27.69	.0271	9
4000	1.69	1.59	1.50	.0451	34.70	34.66	34.60	.0629	27.78	27.763	27.71	.0379	3

Figure C.18.

AREA NINETEEN - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	29.50	26.90	23.03	1.4964	36.04	34.32	33.02	.8187	24.50	22.250	21.09	1.0223	67
10	28.46	26.79	24.26	1.2543	35.96	34.33	33.02	.8808	24.31	22.298	21.16	1.0190	33
20	28.28	26.72	24.27	1.2372	35.96	34.36	33.02	.8736	24.31	22.338	21.25	1.0093	33
30	28.10	26.67	23.60	1.2761	35.97	34.37	33.02	.8764	24.37	22.388	21.31	1.0178	33
50	27.99	25.76	21.91	1.6071	35.96	34.30	33.06	.7843	24.98	22.592	21.99	.9770	28
75	26.99	22.98	17.07	2.6380	35.90	34.38	33.70	.8005	25.13	23.564	22.23	.9130	23
100	23.57	18.34	14.19	2.7818	35.81	34.55	33.89	.9229	25.89	24.827	23.29	.7876	23
125	21.50	16.93	13.03	2.6597	35.70	34.68	34.19	.3241	26.13	25.503	24.08	.6542	23
150	20.09	14.36	12.88	2.2358	35.59	34.76	34.34	.2959	26.33	25.918	24.61	.4768	23
200	16.79	12.68	11.98	1.1326	35.26	34.80	34.71	.1116	26.48	26.310	25.79	.1768	23
250	13.69	11.76	11.27	.6003	34.94	34.75	34.68	.0561	26.67	26.457	26.23	.0823	23
300	11.80	10.98	10.46	.2704	34.76	34.71	34.64	.0333	26.66	26.570	26.46	.0517	23
400	10.27	9.46	8.60	.3590	34.81	34.62	34.53	.0679	26.90	26.763	26.63	.0744	23
500	9.03	8.07	7.42	.3703	34.63	34.55	34.50	.0388	27.04	26.930	26.76	.0760	21
600	7.78	6.93	6.42	.2787	34.60	34.54	34.46	.0372	27.15	27.082	26.93	.0593	15
700	6.56	6.10	5.92	.1693	34.56	34.52	34.44	.0361	27.23	27.181	27.08	.0460	16
800	6.46	5.47	5.29	.1981	34.58	34.52	34.48	.0390	27.33	27.258	27.16	.0438	15
900	5.33	4.96	4.75	.1376	34.62	34.53	34.46	.0414	27.42	27.325	27.23	.0458	16
1000	4.87	4.55	4.43	.1277	34.56	34.53	34.46	.0356	27.41	27.369	27.29	.0399	11
1100	4.25	4.15	4.07	.0759	34.55	34.54	34.52	.0150	27.44	27.430	27.42	.0116	4
1200	3.92	3.81	3.72	.0830	34.56	34.55	34.52	.0200	27.48	27.467	27.45	.0180	4
1300	3.62	3.51	3.50	.0722	34.57	34.56	34.52	.0250	27.51	27.502	27.49	.0096	4
1400	3.34	3.29	3.16	.0810	34.59	34.57	34.54	.0222	27.55	27.537	27.52	.0126	4
1600	3.00	3.00	2.98	.0580	34.60	34.58	34.55	.0222	27.59	27.570	27.55	.0163	4
1750	2.87	2.81	2.53	.0571	34.61	34.60	34.58	.0150	27.65	27.628	27.61	.0136	4
2000	2.20	2.20	2.20	.0000	34.62	34.62	34.62	.0000	27.67	27.670	27.67	.0000	2
2500	1.89	1.87	1.86	.0283	34.65	34.64	34.64	.0071	27.73	27.720	27.71	.0141	2
3000	1.86	1.84	1.82	.0283	34.66	34.65	34.65	.0071	27.73	27.730	27.73	.0000	2

AREA NINETEEN - SUMMER

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	29.87	28.41	27.66	.6799	34.30	33.78	33.27	.3248	21.83	21.359	20.87	.2432	27
10	29.60	28.26	27.23	.6014	34.29	33.74	33.27	.3160	21.76	21.394	20.94	.2295	16
20	29.46	27.88	23.60	1.1858	34.50	33.85	33.50	.2756	22.73	21.580	21.01	.3892	16
30	28.32	27.21	20.79	1.6092	34.98	33.99	33.60	.2079	23.83	21.901	21.32	.6145	16
50	28.09	24.88	16.09	3.0990	34.59	34.23	33.76	.3175	25.90	22.789	21.47	1.0395	16
75	26.04	19.93	14.11	3.8152	34.70	34.45	34.02	.2226	25.95	24.324	22.30	1.1233	16
100	20.50	15.90	13.16	2.3264	34.82	34.62	34.38	.1978	26.16	25.475	24.22	.6290	16
125	16.56	14.09	13.14	.9809	34.85	34.73	34.46	.1036	26.21	25.972	25.40	.2507	15
150	14.11	13.14	12.66	.4132	34.88	34.77	34.68	.0503	26.36	26.219	26.01	.0986	15
200	12.85	12.16	11.78	.2704	34.86	34.80	34.78	.0206	26.50	26.423	26.31	.0496	15
250	12.19	11.48	11.20	.2393	34.81	34.77	34.73	.0186	26.57	26.526	26.42	.0366	13
300	11.32	10.80	10.50	.2234	34.77	34.74	34.71	.0158	26.66	26.625	26.55	.0326	13
400	9.69	9.29	8.77	.1604	34.67	34.65	34.62	.0171	26.88	26.816	26.77	.0240	12
500	8.19	7.83	7.61	.1914	34.60	34.58	34.57	.0259	27.03	26.992	26.95	.0328	8
600	6.99	6.80	6.60	.1393	34.58	34.56	34.50	.0299	27.16	27.117	27.07	.0333	6
700	6.19	6.00	5.82	.1303	34.57	34.56	34.53	.0182	27.26	27.222	27.20	.0217	5
800	5.59	5.38	5.18	.1163	34.57	34.56	34.54	.0130	27.33	27.298	27.28	.0205	5
900	5.02	4.90	4.78	.0997	34.57	34.56	34.54	.0122	27.39	27.360	27.34	.0212	5
1000	4.50	4.44	4.39	.0791	34.58	34.56	34.54	.0191	27.44	27.418	27.40	.0171	4
1100	4.03	4.03	4.03	.0000	34.56	34.56	34.56	.0000	27.46	27.460	27.46	.0000	1

AREA NINETEEN - SPRING

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	30.66	29.26	27.70	.6120	34.34	33.89	33.21	.3661	21.92	21.164	20.49	.3637	34
10	30.58	29.12	27.91	.6116	34.35	33.76	33.23	.3550	21.95	21.105	20.49	.4200	23
20	30.42	28.67	26.18	1.0076	34.61	33.80	33.26	.3518	22.62	21.287	20.70	.4802	23
30	30.19	27.89	24.95	1.4341	34.58	33.86	33.42	.3269	22.81	21.580	20.78	.5293	23
50	28.05	25.61	21.19	2.4380	34.61	34.02	33.70	.2121	24.02	22.442	21.23	.7698	23
75	24.55	20.63	16.83	2.6205	34.64	34.37	34.05	.1704	25.25	24.106	22.85	.8185	23
100	19.82	16.60	14.28	1.8389	34.80	34.66	34.42	.1153	25.95	25.339	24.16	.5126	23
125	15.94	14.23	12.89	1.0221	34.86	34.77	34.66	.0442	26.27	25.948	25.55	.2851	23
150	13.92	12.96	12.19	.4561	34.88	34.80	34.53	.0613	26.38	26.256	26.03	.1021	23
200	12.70	11.99	11.56	.3203	34.83	34.78	34.73	.0267	26.51	26.436	26.33	.0468	23
250	11.97	11.34	10.79	.3080	34.79	34.75	34.73	.0232	26.62	26.534	26.45	.0409	22
300	11.10	10.72	10.30	.2169	34.76	34.72	34.70	.0198	26.68	26.623	26.58	.0264	19
400	9.88	9.44	8.89	.2716	34.68	34.65	34.59	.0223	26.86	26.784	26.73	.0313	18
500	8.66	8.10	7.46	.3177	34.61	34.58	34.55	.0162	27.03	26.945	26.85	.0481	17
600	7.20	6.98	6.53	.1920	34.57	34.58	34.51	.0187	27.19	27.082	27.03	.0327	17
700	6.54	6.15	5.75	.1773	34.57	34.55	34.51	.0183	27.23	27.184	27.11	.0301	16
800	5.70	5.51	5.08	.1649	34.57	34.53	34.50	.0188	27.31	27.265	27.23	.0253	15
900	5.31	4.98	4.61	.1962	34.56	34.54	34.50	.0169	27.36	27.327	27.27	.0231	16
1000	4.68	4.49	4.19	.1070	34.57	34.55	34.51	.0166	27.43	27.390	27.35	.0197	13
1100	4.21	4.00	3.64	.1023	34.59	34.56	34.54	.0121	27.48	27.447	27.43	.0171	12
1200	3.88	3.76	3.53	.1129	34.59	34.57	34.55	.0136	27.51	27.489	27.48	.0126	8
1300	3.60	3.47	3.26	.1139	34.59	34.58	34.56	.0107	27.54	27.523	27.51	.0111	7
1400	3.33	3.21	3.03	.1125	34.60	34.59	34.57	.0141	27.57	27.560	27.55	.0100	6
1600	3.09	3.06	3.05	.0231	34.61	34.60	34.59	.0115	27.59	27.583	27.58	.0058	3
1750	2.60	2.58	2.56	.0208	34.63	34.62	34.62	.0058	27.65	27.640	27.63	.0100	3
2000	2.18	2.09	2.01	.1202	34.66	34.65	34.63	.0212	27.73	27.705	27.68	.0354	2
2500	1.86	1.86	1.86	.0000	34.67	34.66	34.65	.0141	27.73	27.730	27.73	.0000	2
3000	1.86	1.86	1.86	.0000	34.67	34.67	34.67	.0000	27.75	27.750	27.75	.0000	1

AREA NINETEEN - FALL

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	29.40	27.90	26.60	.8197	33.96	33.67	33.20	.2178	21.93	21.366	21.01	.2459	19
10	28.39	26.81	24.60	1.2193	34.03	33.63	33.33	.2721	22.75	21.764	21.01	.5667	11
20	28.37	26.50	23.32	1.7122	34.12	33.71	33.33	.2079	23.19	21.911	21.02	.7222	11
30	28.38	24.90	21.21	2.6929	34.36	33.93	33.31	.3713	23.94	22.561	21.02	1.0205	11
50	25.60	19.95	14.96	3.2291	34.81	34.45	33.96	.2820	25.85	24.329	22.36	1.0378	11
75	17.03	15.36	13.29	1.2081	34.87	34.73	34.57	.1010	26.25	25.490	25.29	.3108	11
100	15.31	13.82	12.87	.8292	34.86	34.79	34.78	.0416	26.32	26.079	25.81	.1748	11
125	14.14	12.99	12.46	.5479	34.87	34.81	34.76	.0376	26.40	26.261	26.07	.0985	11
150	13.96	12.96	11.95	.4392	34.87	34.80	34.76	.0446	26.46	26.369	26.21	.0683	11
200	12.90	11.76	11.22	.6312	34.88	34.78	34.70	.0836	26.67	26.477	26.32	.0752	11
250	12.09	11.18	10.66	.4503	34.86	34.75	34.67	.0595	26.66	26.564	26.48	.0533	11
300	11.22	10.49	10.01	.4106	34.80	34.70	34.62	.0402	26.71	26.646	26.59	.0406	11
400	9.70	9.03	8.76	.3064	34.71	34.62	34.55	.0412	26.91	26.829	26.76	.0414	9
500	8.00	7.72	7.60	.1621	34.66	34.57	34.51	.0435	27.04	26.997	26.95	.0308	9
600	7.00	6.79	6.60	.1091	34.62	34.53	34.50	.0466	27.13	27.100	27.08	.0151	8
700	6.31	6.09	5.89	.1639	34.60	34.52	34.50	.0460	27.21	27.186	27.16	.0169	8
800	5.64	5.41	5.28	.1819	34.59	34.51	34.48	.0460	27.29	27.260	27.23	.0193	8
900	5.13	4.89	4.78	.1360	34.59	34.52	34.50	.0381	27.37	27.326	27.29	.0302	8
1000	4.77	4.48	4.29	.1619	34.59	34.53	34.48	.0410	27.44	27.388	27.35	.0321	8
1100	4.40	4.16	3.97	.0876	34.59	34.55	34.48	.0497	27.48	27.430	27.38	.0374	5
1200	4.20	4.02	3.96	.1760	34.61	34.60	34.59	.0141	27.50	27.480	27.46	.0283	2
1300	3.93	3.81	3.60	.1740	34.62	34.60	34.59	.0283	27.54	27.510	27.48	.0424	2
1400	3.67	3.59	3.51	.1030	34.63	34.60	34.57	.0424	27.57	27.535	27.50	.0496	2
1600	3.42	3.27	3.13	.2001	34.62	34.59	34.57	.0354	27.59	27.555	27.52	.0496	2
1750	2.89	2.73	2.58	.2192	34.63	34.62	34.62	.0071	27.68	27.630	27.61	.0283	2
2000	2.30	2.29	2.18	.0849	34.68	34.65	34.63	.0141	27.70	27.685	27.67	.0212	2
2500	1.96	1.93	1.91	.0389	34.66	34.66	34.65	.0191	27.73	27.730	27.73	.0000	2
3000	1.77	1.77	1.77	.0000	34.69	34.69	34.69	.0000	27.76	27.760	27.76	.0000	1

Figure C.19.

AREA TWENTY - WINTER

*** STATISTICAL SUMMARY ***

DEPTH (M)	TEMPERATURE (C) MAX	MEAN	MIN	ST DEV	SALINITY (PPT) MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.83	25.31	[illegible]	1.8022	34.92	34.12	32.50	.6918	24.00	22.566	20.64	.7899	66
10	27.48	24.62	18.34	1.8247	35.01	34.26	32.88	.5650	25.21	22.698	21.03	.8688	35
20	26.27	22.25	16.57	2.2907	35.14	34.60	33.82	.3544	25.65	23.836	22.12	.8454	35
30	25.25	20.20	14.93	2.5780	35.27	34.75	34.16	.3038	26.03	24.510	22.64	.8672	35
50	21.20	16.76	13.87	2.1636	35.26	34.90	34.44	.1744	26.23	25.408	24.03	.5923	26
75	17.73	14.57	13.29	1.1400	35.28	34.96	34.80	.1064	26.31	26.042	25.57	.2137	25
100	14.54	13.59	12.91	.4731	35.07	34.92	34.82	.0514	26.36	26.227	26.04	.0908	25
125	13.88	13.20	12.82	.2983	35.05	34.92	34.86	.0379	26.37	26.301	26.18	.0522	25
150	13.43	13.00	12.73	.1955	35.01	34.91	34.86	.0274	26.42	26.337	26.27	.0345	25
200	12.97	12.77	12.66	.1216	34.92	34.90	34.88	.0134	26.40	26.375	26.34	.0178	25
250	12.75	12.36	11.80	.2211	34.89	34.87	34.83	.0201	26.51	26.433	26.37	.0335	25
300	12.14	11.30	10.56	.4455	34.87	34.81	34.73	.0379	26.67	26.585	26.46	.0565	24
400	9.95	9.18	8.67	.3578	34.73	34.68	34.64	.0226	26.92	26.855	26.77	.0468	17
500	8.28	7.80	6.92	.4132	34.64	34.61	34.58	.0203	27.16	27.019	26.95	.0532	16
600	7.38	6.79	6.34	.3960	34.62	34.57	34.54	.0313	27.19	27.128	27.05	.0531	5
700	6.23	5.94	5.71	.2663	34.54	34.53	34.53	.0058	27.23	27.213	27.18	.0289	3
800	5.68	5.42	5.09	.3001	34.53	34.53	34.52	.0058	27.31	27.273	27.25	.0321	3
900	5.33	5.15	4.90	.2219	34.53	34.53	34.53	.0000	27.33	27.300	27.28	.0265	3
1000	4.88	4.79	4.67	.1097	34.54	34.54	34.53	.0058	27.37	27.350	27.34	.0173	3

AREA TWENTY - SUMMER

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	25.87	21.63	16.92	2.6177	35.16	34.62	33.71	.3270	25.53	24.025	22.25	.9957	46
10	25.86	21.37	16.43	2.6953	35.16	34.64	33.73	.3367	25.63	24.106	22.26	1.0105	27
20	25.84	20.61	14.55	3.5616	35.17	34.68	33.76	.3368	26.05	24.320	22.28	1.1587	26
30	25.64	19.79	14.18	3.6280	35.15	34.75	34.03	.2808	26.15	24.588	22.54	1.1334	26
50	25.54	17.70	13.65	3.7346	35.13	34.88	34.33	.1992	26.26	25.194	22.69	1.0775	26
75	24.53	15.35	13.45	2.1444	35.18	34.96	34.68	.1001	26.29	25.857	23.44	.5446	26
100	16.29	13.97	13.28	.6300	35.03	34.95	34.76	.0534	26.32	26.172	25.65	.1380	26
125	14.95	13.51	12.95	.2860	35.00	34.94	34.81	.0340	26.38	26.259	26.17	.0517	26
150	13.68	13.26	12.76	.2670	34.97	34.93	34.86	.0241	26.40	26.300	26.25	.0445	26
200	13.29	12.84	12.31	.2550	34.98	34.91	34.84	.0268	26.43	26.368	26.32	.0370	26
250	12.97	12.50	11.65	.3154	34.92	34.89	34.80	.0276	26.51	26.421	26.35	.0406	26
300	12.52	11.57	10.47	.5059	34.89	34.82	34.76	.0393	26.68	26.547	26.39	.0709	26
400	10.03	9.25	6.39	.4396	34.75	34.68	34.53	.0443	26.96	26.847	26.70	.0579	26
500	8.31	7.68	7.40	.2156	34.65	34.61	34.47	.0374	27.07	27.007	26.89	.0356	22
600	7.19	6.95	6.55	.2131	34.60	34.58	34.52	.0233	27.15	27.115	27.05	.0331	13
700	6.42	6.07	5.73	.2066	34.58	34.56	34.52	.0178	27.25	27.215	27.15	.0288	12
800	5.73	5.42	5.25	.1553	34.57	34.55	34.53	.0133	27.31	27.269	27.25	.0176	11
900	5.14	4.94	4.72	.1344	34.57	34.55	34.53	.0117	27.38	27.347	27.32	.0205	11
1000	4.62	4.47	4.30	.1152	34.57	34.56	34.54	.0111	27.43	27.403	27.38	.0180	7
1100	4.15	4.15	4.15	.0000	34.55	34.55	34.55	.0000	27.44	27.440	27.44	.0000	1
1200	3.83	3.83	3.83	.0000	34.56	34.56	34.56	.0000	27.48	27.480	27.48	.0000	1
1300	3.55	3.55	3.55	.0000	34.57	34.57	34.57	.0000	27.51	27.510	27.51	.0000	1
1400	3.29	3.29	3.29	.0000	34.57	34.57	34.57	.0000	27.54	27.540	27.54	.0000	1
1500	3.06	3.06	3.06	.0000	34.58	34.58	34.58	.0000	27.56	27.560	27.56	.0000	1
1750	2.60	2.60	2.60	.0000	34.60	34.60	34.60	.0000	27.62	27.620	27.62	.0000	1
2000	2.31	2.31	2.31	.0000	34.63	34.63	34.63	.0000	27.67	27.670	27.67	.0000	1
2500	1.95	1.95	1.95	.0000	34.66	34.66	34.66	.0000	27.73	27.730	27.73	.0000	1
3000	1.76	1.76	1.76	.0000	34.66	34.66	34.66	.0000	27.75	27.750	27.75	.0000	1

AREA TWENTY - SPRING

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	27.17	25.10	21.43	1.4064	35.23	34.78	32.76	.6261	24.13	23.121	21.04	.7361	26
10	26.81	23.68	20.40	2.1876	35.17	34.44	32.76	.7320	24.45	23.312	21.12	1.0416	10
20	24.13	21.64	19.00	1.5656	35.17	34.72	34.20	.3291	25.16	24.178	23.44	.5531	10
30	23.95	19.92	16.69	2.1396	35.25	34.75	34.50	.2175	25.75	24.669	23.72	.6002	10
50	21.50	16.60	15.66	1.7644	35.23	34.95	34.82	.1907	26.01	25.526	24.46	.4199	10
75	18.77	14.95	14.04	1.3826	35.09	34.96	34.85	.0615	26.25	25.950	25.16	.3008	10
100	16.35	13.98	13.05	.8774	35.06	34.94	34.87	.0547	26.35	26.155	25.73	.1692	10
125	14.47	13.44	12.98	.3944	35.03	34.93	34.84	.0403	26.36	26.261	26.12	.0631	10
150	13.75	13.19	12.91	.2433	35.00	34.92	34.84	.0304	26.37	26.307	26.25	.0383	10
200	13.04	12.92	12.51	.1607	34.93	34.90	34.86	.0190	26.34	26.361	26.33	.0213	10
250	12.95	12.53	11.75	.3477	34.91	34.86	34.81	.0324	26.50	26.403	26.35	.0440	10
300	12.45	11.64	11.04	.5207	34.86	34.82	34.76	.0439	26.60	26.533	26.42	.0634	10
400	9.93	9.43	8.87	.2757	34.73	34.70	34.65	.0244	26.88	26.826	26.77	.0291	10
500	8.51	8.30	8.05	.2447	34.64	34.63	34.62	.0100	27.00	26.960	26.93	.0356	4
600	7.59	7.40	7.01	.3344	34.60	34.59	34.58	.0115	27.10	27.060	27.04	.0346	3
700	6.61	6.46	6.16	.2598	34.58	34.57	34.55	.0173	27.19	27.170	27.16	.0173	3
800	5.63	5.63	5.63	.0000	34.55	34.55	34.55	.0000	27.26	27.260	27.26	.0000	2
900	5.09	5.09	5.09	.0000	34.54	34.54	34.54	.0000	27.32	27.320	27.32	.0000	2
1000	4.65	4.65	4.65	.0000	34.55	34.55	34.55	.0000	27.38	27.380	27.38	.0000	2
1100	4.23	4.23	4.23	.0000	34.56	34.56	34.56	.0000	27.43	27.430	27.43	.0000	2
1200	3.88	3.88	3.88	.0000	34.56	34.56	34.56	.0000	27.48	27.480	27.48	.0000	2
1300	3.67	3.67	3.67	.0000	34.57	34.57	34.57	.0000	27.50	27.500	27.50	.0000	2
1400	3.46	3.46	3.46	.0000	34.58	34.58	34.58	.0000	27.52	27.520	27.52	.0000	2
1500	3.22	3.22	3.22	.0000	34.59	34.59	34.59	.0000	27.56	27.560	27.56	.0000	2
1750	2.68	2.68	2.68	.0000	34.62	34.62	34.62	.0000	27.63	27.630	27.63	.0000	2
2000	2.26	2.26	2.26	.0000	34.63	34.63	34.63	.0000	27.67	27.670	27.67	.0000	2

AREA TWENTY - FALL

DEPTH (M)	TEMP MAX	MEAN	MIN	ST DEV	SAL MAX	MEAN	MIN	ST DEV	SIGMA-T MAX	MEAN	MIN	ST DEV	NUM
0	25.29	21.66	16.77	2.0827	34.87	34.36	33.61	.4589	24.93	23.824	22.28	.9221	38
10	25.08	20.79	16.71	2.1326	34.87	34.42	33.61	.4344	25.00	24.108	22.29	.9149	22
20	25.05	19.79	17.61	2.5103	34.93	34.51	33.61	.4400	25.25	24.435	22.30	1.0121	22
30	25.03	18.44	15.86	2.8036	35.01	34.66	33.58	.4396	25.64	24.886	22.31	1.0737	22
50	22.75	16.19	13.42	2.2713	35.07	34.84	34.04	.2577	26.20	25.573	23.30	.7174	22
75	16.66	14.39	13.15	1.0852	35.08	34.92	34.76	.0852	26.32	26.050	25.42	.2531	22
100	14.80	13.60	12.64	.6586	35.03	34.92	34.79	.0560	26.37	26.217	25.98	.1230	22
125	14.27	13.18	12.44	.4576	34.98	34.90	34.78	.0448	26.40	26.296	26.11	.0753	22
150	14.08	12.89	12.31	.3860	34.99	34.89	34.78	.0399	26.43	26.345	26.14	.0662	22
200	13.39	12.55	11.91	.3306	34.93	34.88	34.79	.0333	26.50	26.400	26.27	.0487	20
250	12.75	12.32	11.60	.2915	34.91	34.86	34.76	.0438	26.55	26.430	26.37	.0475	19
300	12.37	11.66	10.94	.3505	34.87	34.82	34.70	.0480	26.63	26.526	26.43	.0536	19
400	10.31	9.74	9.28	.3042	34.76	34.70	34.60	.0493	26.85	26.782	26.71	.0391	18
500	9.00	8.28	7.62	.3482	34.68	34.62	34.50	.0568	27.04	26.948	26.85	.0480	17
600	7.63	7.21	6.70	.2587	34.61	34.57	34.46	.0484	27.14	27.068	26.98	.0445	17
700	6.59	6.30	5.98	.1693	34.58	34.55	34.45	.0427	27.23	27.171	27.09	.0386	16
800	5.82	5.60	5.29	.1359	34.57	34.54	34.44	.0412	27.30	27.254	27.17	.0366	15
900	5.37	5.06	4.82	.1513	34.57	34.53	34.42	.0454	27.36	27.310	27.23	.0428	13
1000	4.87	4.62	4.34	.1544	34.57	34.53	34.41	.0463	27.42	27.363	27.27	.0472	12
1100	4.36	4.24	4.04	.1118	34.57	34.53	34.41	.0506	27.45	27.407	27.31	.0456	11
1200	3.98	3.88	3.73	.0875	34.58	34.57	34.57	.0049	27.50	27.480	27.46	.0115	7
1300	3.67	3.59	3.46	.0804	34.60	34.58	34.58	.0082	27.53	27.515	27.50	.0105	6
1400	3.41	3.32	3.19	.0866	34.61	34.59	34.58	.0098	27.57	27.550	27.54	.0126	6
1500	3.19	3.08	3.00	.0804	34.62	34.60	34.59	.0110	27.59	27.575	27.56	.0108	6
1750	2.59	2.56	2.48	.0407	34.62	34.62	34.61	.0052	27.64	27.638	27.63	.0041	6
2000	2.32	2.27	2.20	.0429	34.64	34.63	34.62	.0052	27.68	27.675	27.67	.0045	6
2500	1.94	1.87	1.82	.0441	34.66	34.65	34.65	.0055	27.73	27.727	27.71	.0082	6
3000	1.77	1.74	1.69	.0346	34.67	34.66	34.66	.0058	27.75	27.750	27.75	.0000	4

Figure C.20.

APPENDIX D
METEOROLOGICAL DATA FOR EASTERN PACIFIC SURVEY AREA

Data showing various tropical cyclone stages and wind roses for eastern Pacific areas are given.

Data from U. S. Naval Weather Service sources.

Note: 1 knot ≈ 0.5 m/sec for the figures in this appendix.

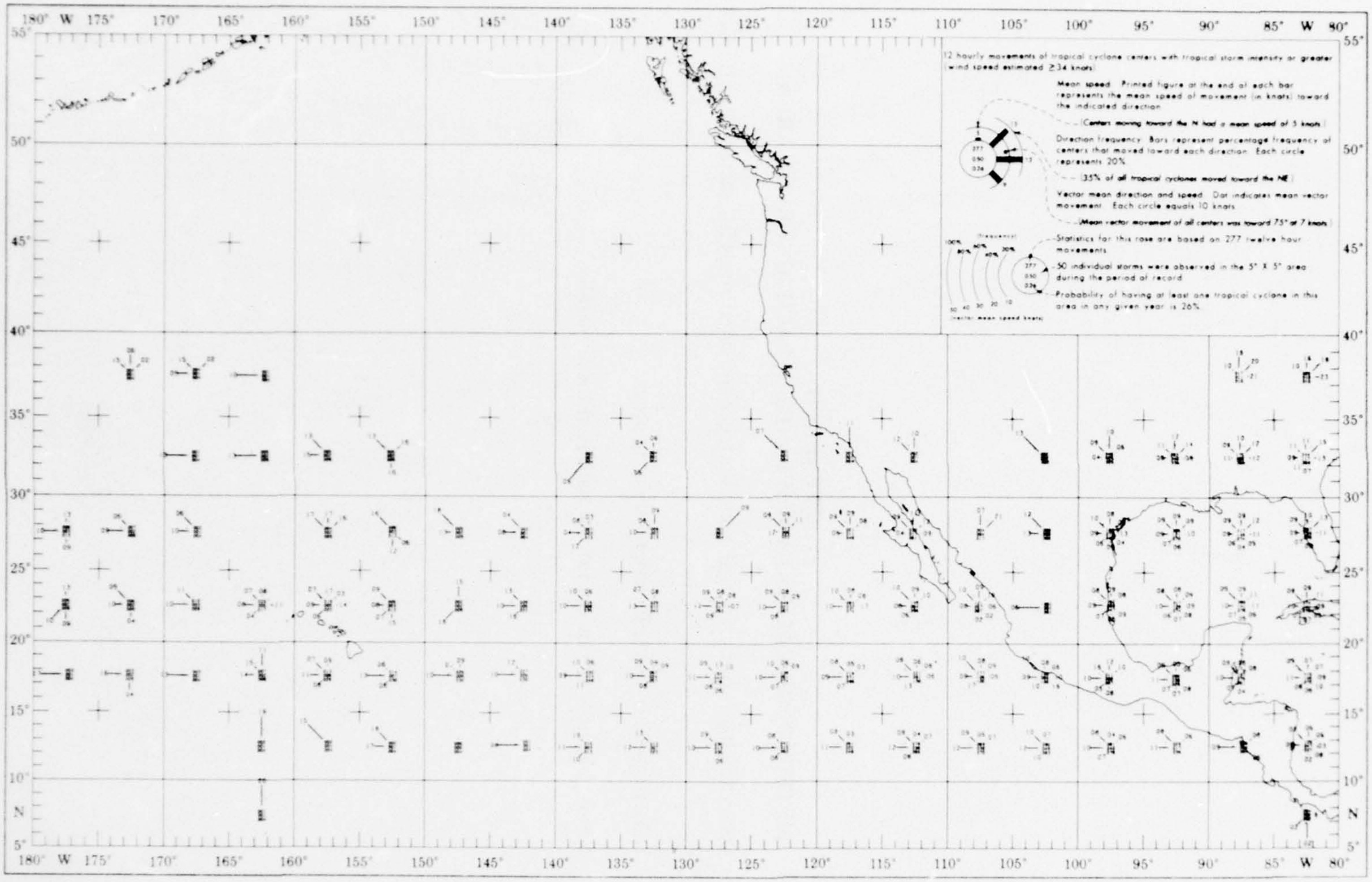


Figure D.1. Tropical cyclone (≥ 34 knot) stage statistics for 5-degree squares in the eastern Pacific, data from 1949-1971. (Reproduced from Naval Weather Service, Ref. 34).

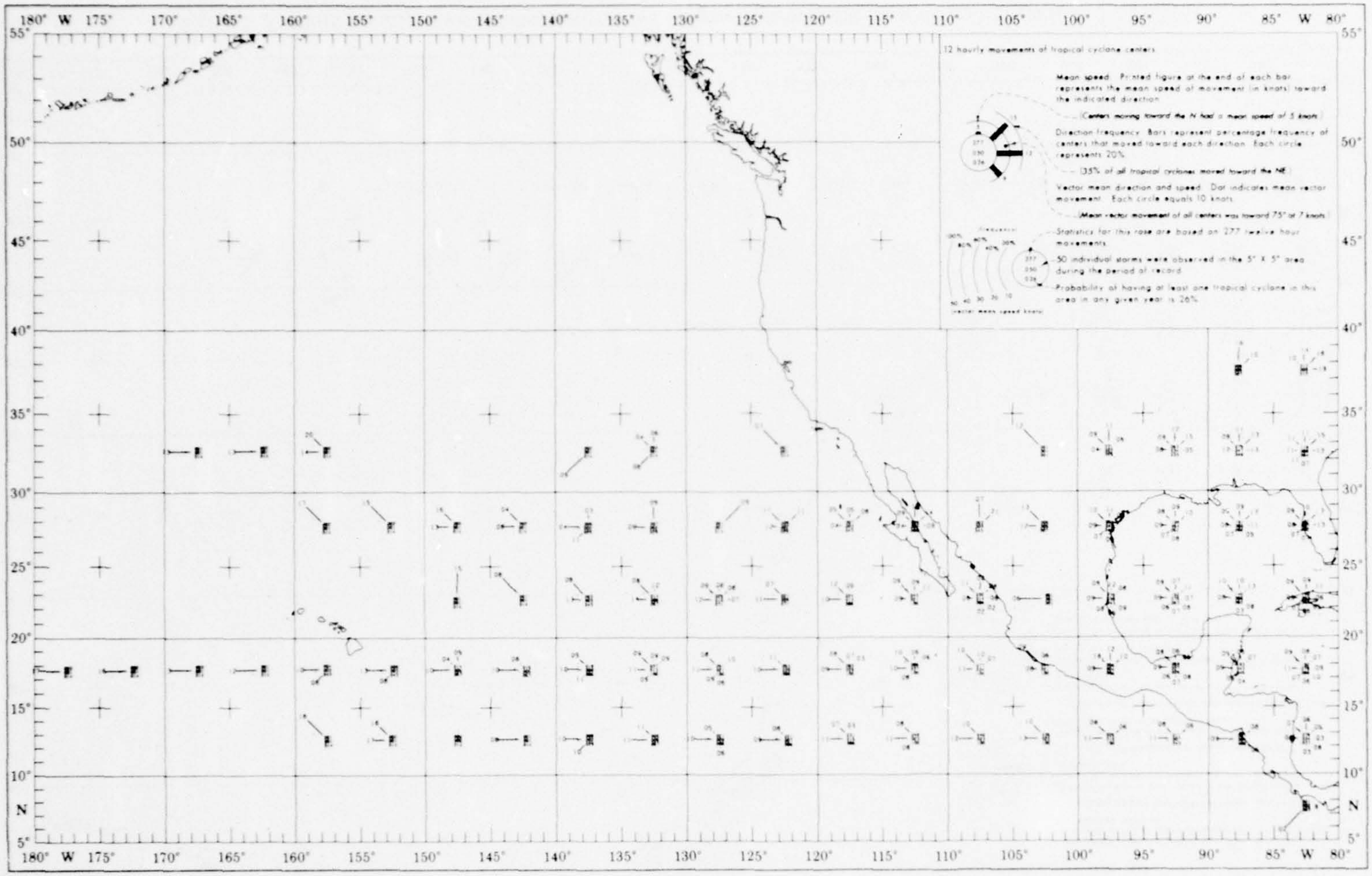


Figure D.2. Tropical storm stage (48-63 knot) statistics for 5-degree squares in the eastern Pacific; data from 1965-1971. (Reproduced from Naval Weather Service, Ref. 34).

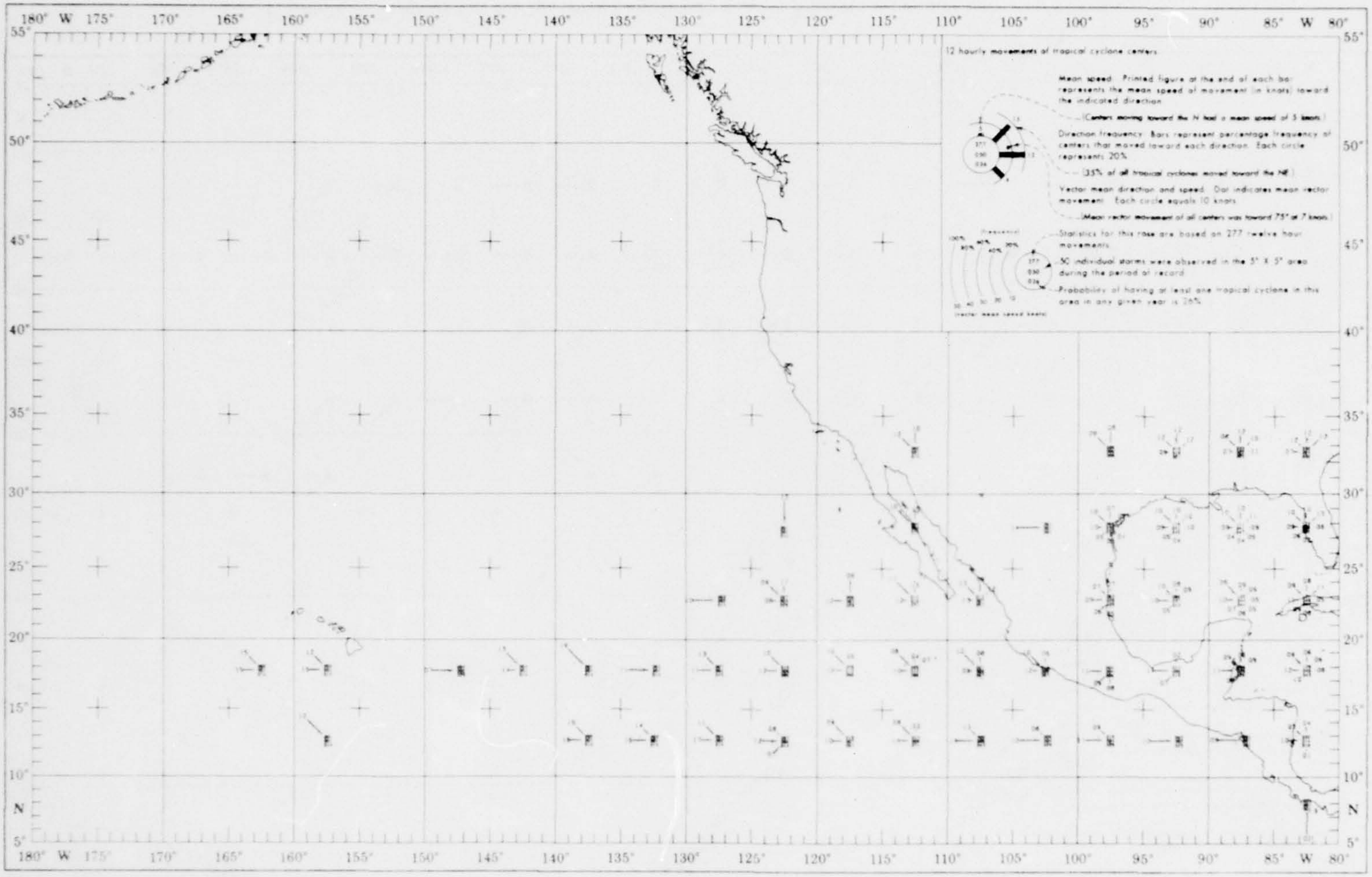


Figure D.3. Hurricane stage (> 64 knots) statistics for 5-degree squares in the eastern Pacific; data from 1965-1971. (Reproduced from Naval Weather Service, Ref. 34)

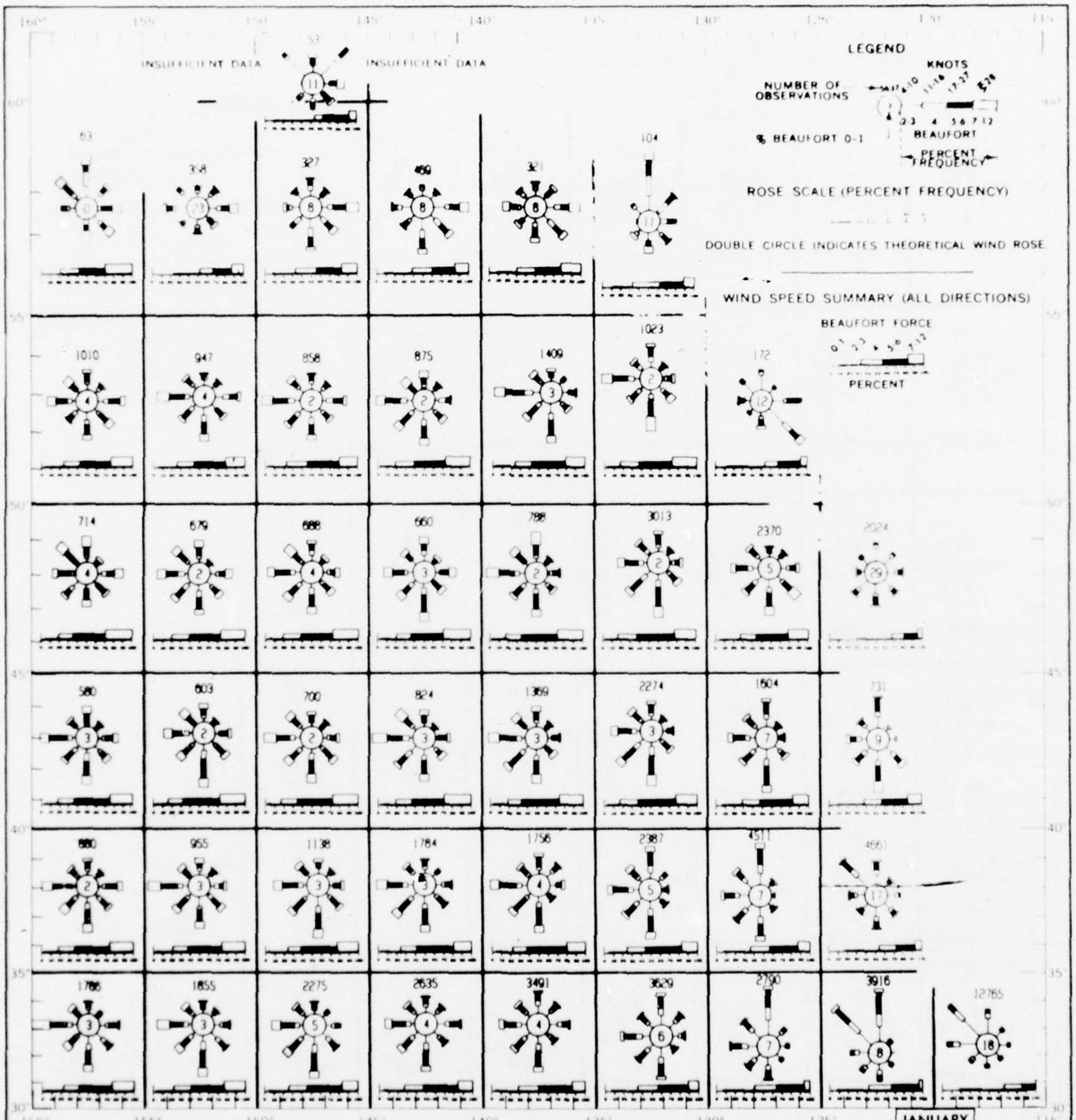


Figure D.4. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30°N for January. (U. S. Navy sources).

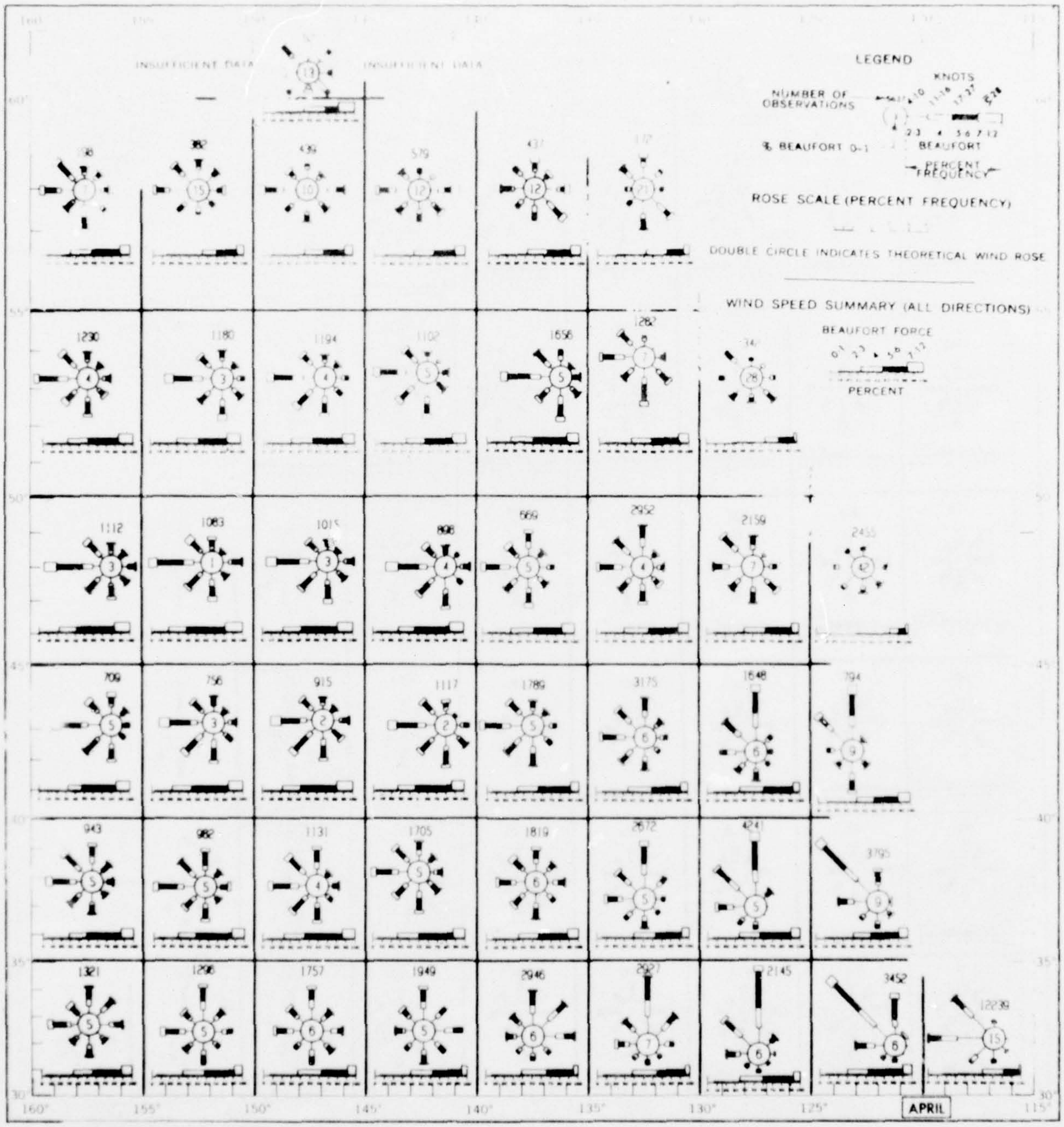


Figure D.5. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30° for April. (U. S. Navy sources).

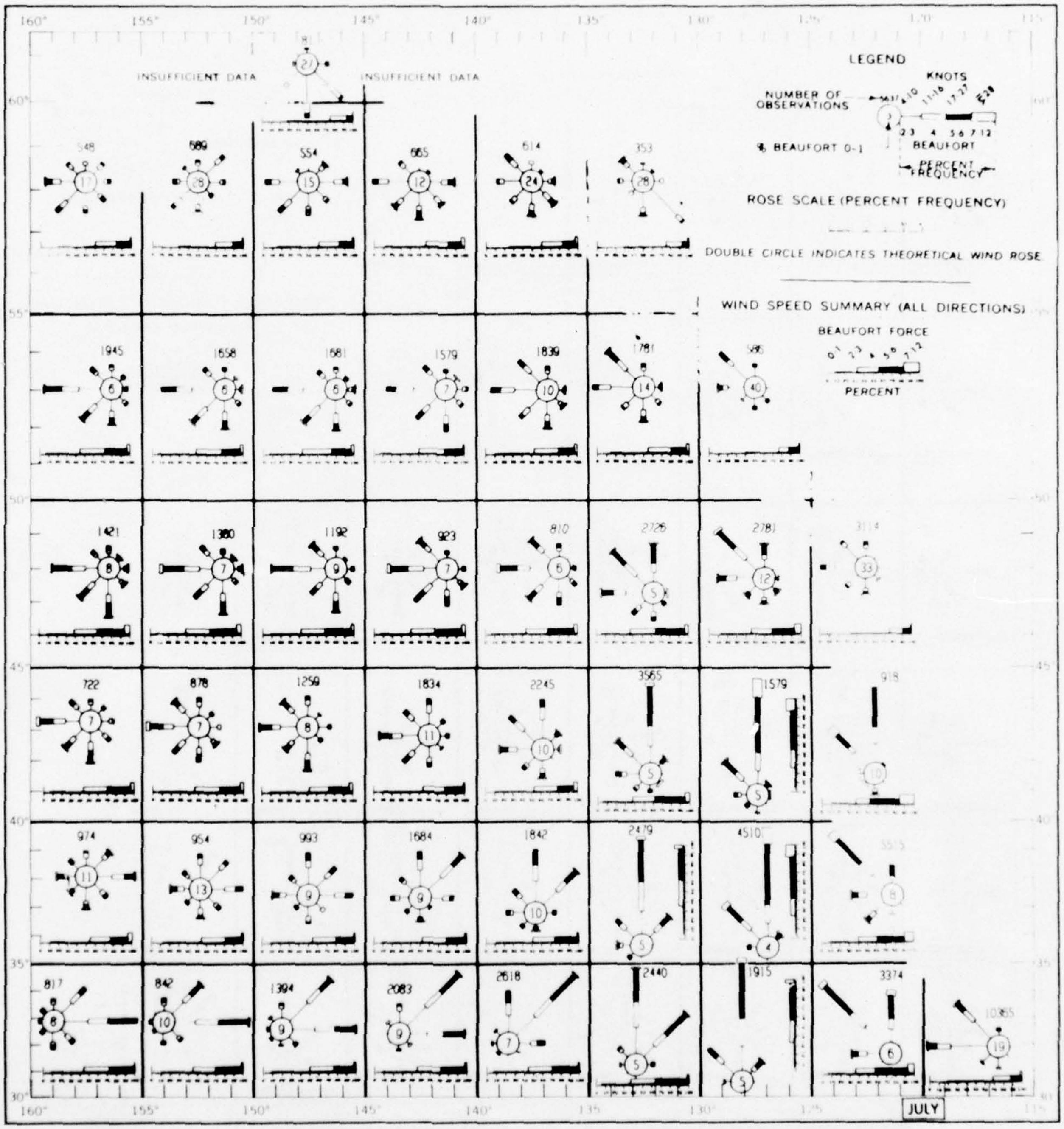


Figure D.6. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30°N for July. (U. S. Navy sources).

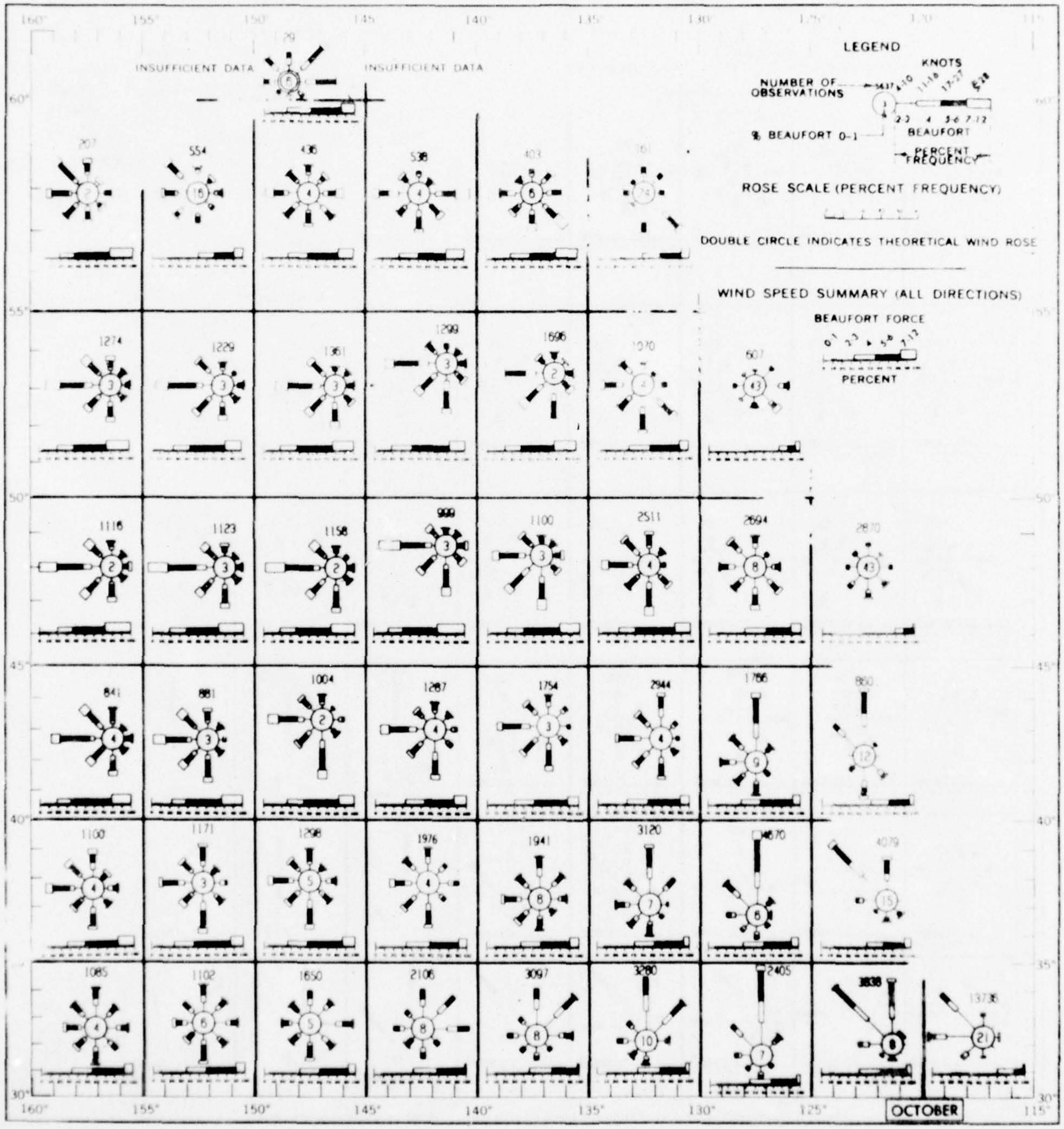


Figure D.7. Wind roses giving percent frequency of speed and direction for the northeastern Pacific north of 30° for October. (U. S. Navy sources).

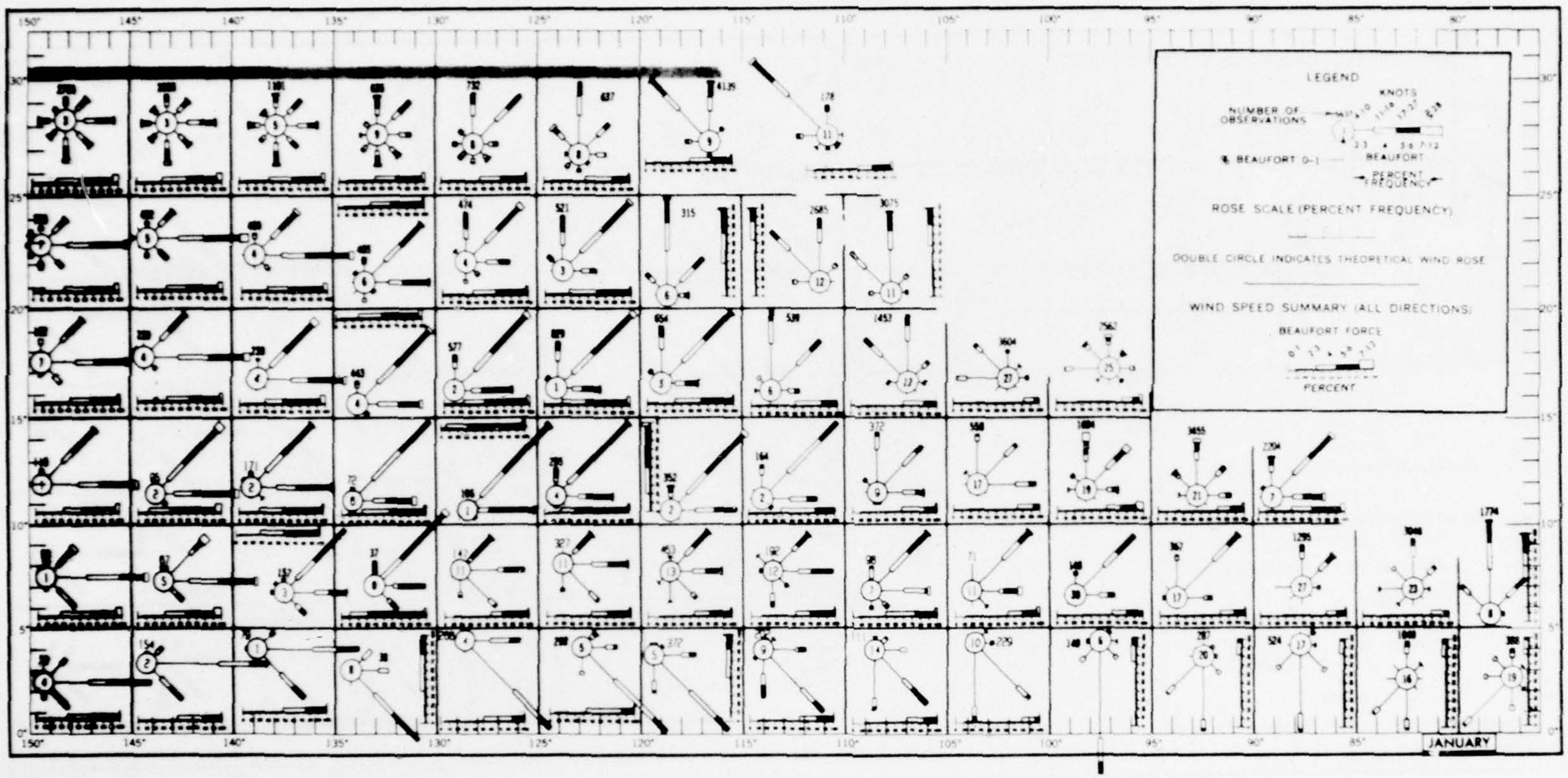


Figure D.8. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for January. (U. S. Navy sources).

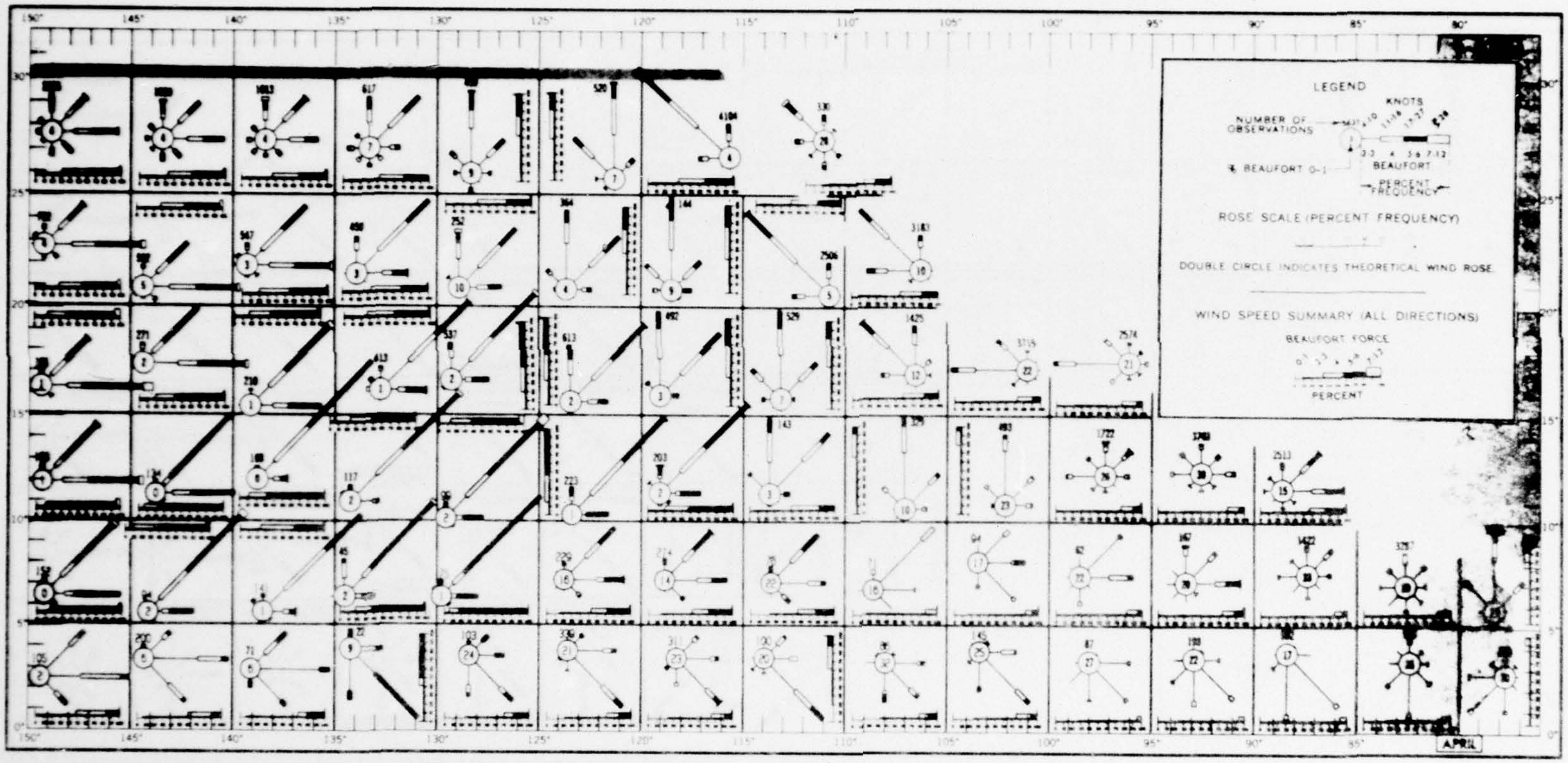


Figure D.9. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30° for April. (U. S. Navy sources).

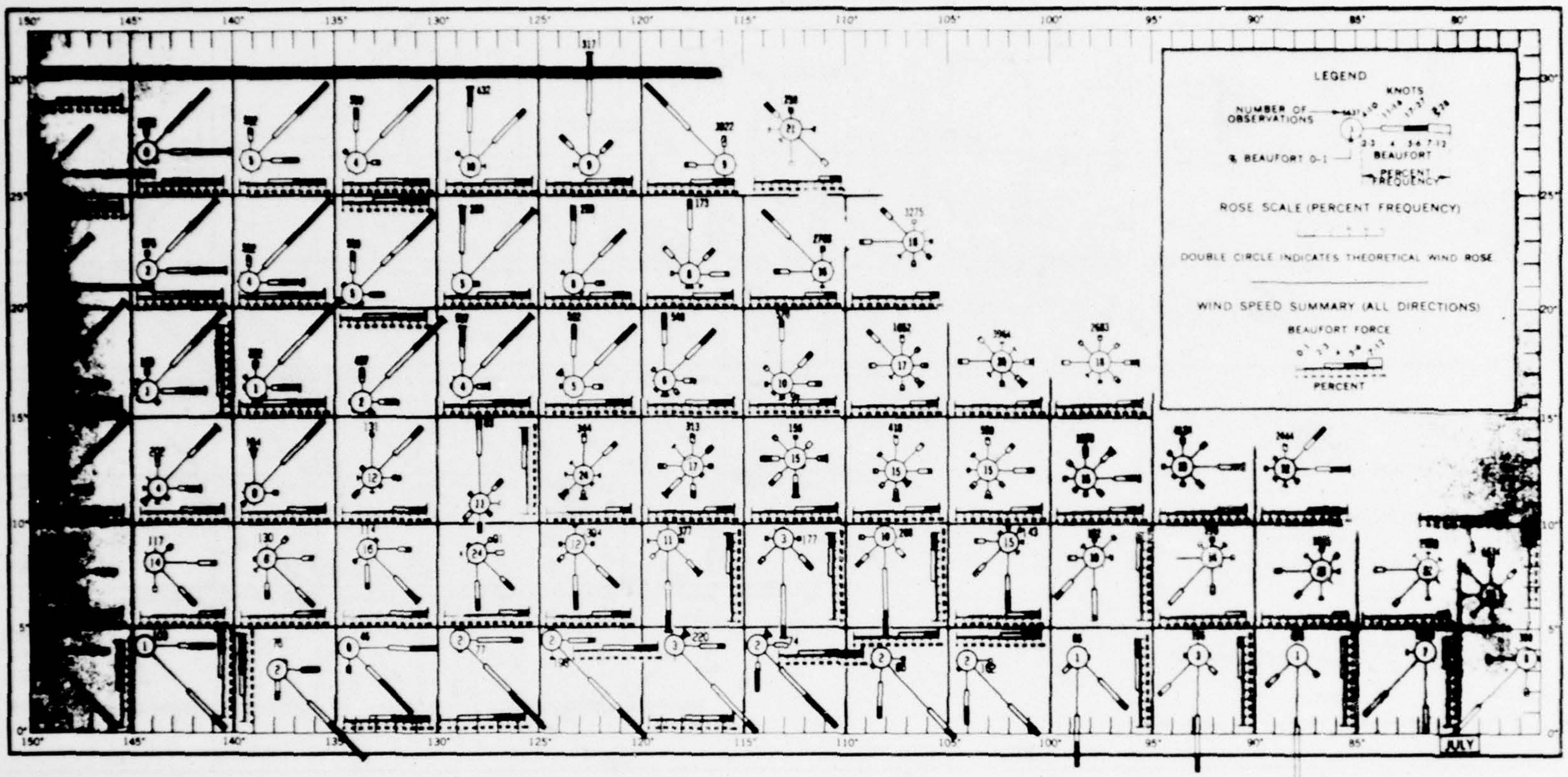


Figure D.10. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for July. (U. S. Navy sources).

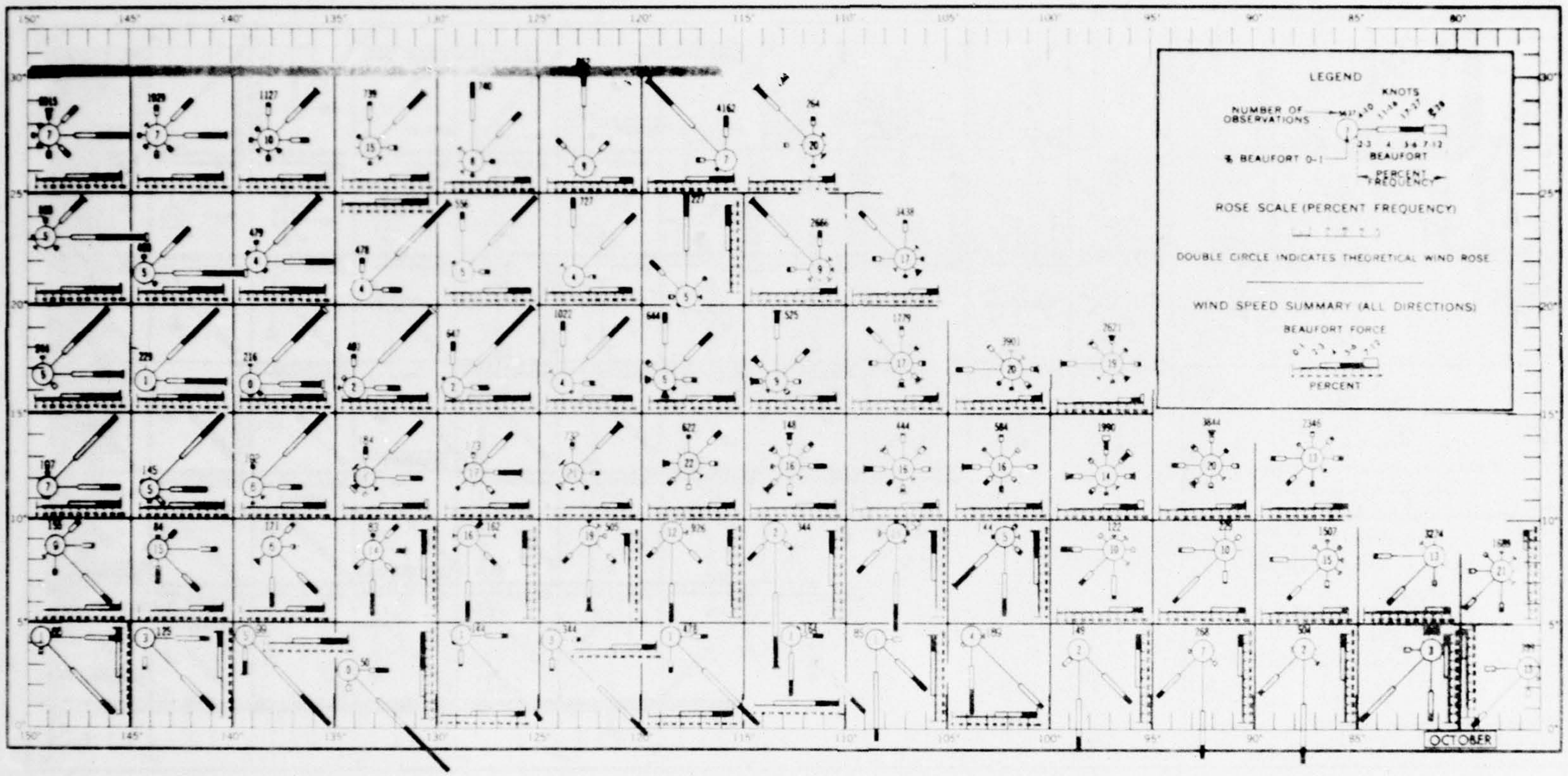


Figure D.11. Wind roses giving percent frequency of speed and direction for the northeastern Pacific south of 30°N for October. (U. S. Navy sources).

APPENDIX E
DISCUSSION OF STORM-GENERATED CURRENTS

Severe storms and hurricanes can generate intense temporary current fields in the vicinity of the storm. The potential magnitude of these currents is of concern to OFEF for engineering design and overall survivability of the farm structure and kelp plants. Actual measurements of currents during severe storms are rare, principally due to the difficulty of making them under extremely adverse conditions. Nearly all literature references on storm-driven currents deal with theoretical computation of currents associated with storm surge (Ref. 50). Until very recently, these computational methods employed highly simplified equations that could at best only produce rough estimates of current conditions.

The response of the ocean surface-to-wind stresses is realized in several ways. The most apparent responses, and the most important in terms of OFEF structural dynamics, are surface waves and horizontal water transport. The total flow field to which a structure is subjected during storm-induced periods consists of wave-associated particle velocities plus the more slowly varying current component. Two papers which consider the effect of currents and waves on moored systems, and are applicable to Phase 1, 2, and possibly early Phase 3 OFEF's are Refs. 51 and 52.

The only actual current measurement ever made during a severe cyclonic storm of hurricane intensity was taken from NOAA Buoy EB-10 during Hurricane Eloise, September 1975 (Ref. 53). This hurricane reached the coast of Florida with 110-knot (57-m/sec) winds at 1200, 23 September 1975. The wind magnitude, current speed, and wave height chronology are given in Figure E.1. The eye of the hurricane passed within 10 miles (16 kilometers) of buoy EB-10 at 0200, 23 September, approximately 150 miles (240 kilometers) south of Mississippi (Position (a) on Fig. E.1). The maximum measured wind speed by aircraft was 95 knots (49 m/sec), the wind speed at the buoy was 68 knots (35 m/sec) and occurred at 0100, 23 September, just prior to the passage of the eye. Wave response parallels wind speed precisely showing a maximum height of 8.8 meters during the same hour as the maximum wind speed. Currents at 50 meters, however, showed a delay of nearly 24 hours between the build up of the wind and the increase in current speed. Average current speed prior to the storm passage was 0.6 knot (0.3 m/sec) increasing to 1.8 knots (0.9 m/sec) over a 12-hour period (about the same length of time as the increase in wind speed to maximum magnitude). Shortly after the storm, oscillations (26- to 27-hour periods) in current speed with decreasing magnitude and direction were observed; these were detectable for two weeks after passage of the hurricane. Although the data for Figure E.1 were taken in the Gulf of Mexico, the general relationships probably are similar for cyclonic storms in the eastern Pacific. Surface currents were not measured from EB-10 and would be extremely difficult to measure in a storm due to wave and surface chop action.

Surface currents can be measured indirectly by measuring ship drift. One such measurement was made shortly after the passage of a typhoon in the northwest Pacific. A Japanese research vessel showed an anticyclonic drift pattern, 48 hours after the passage of a

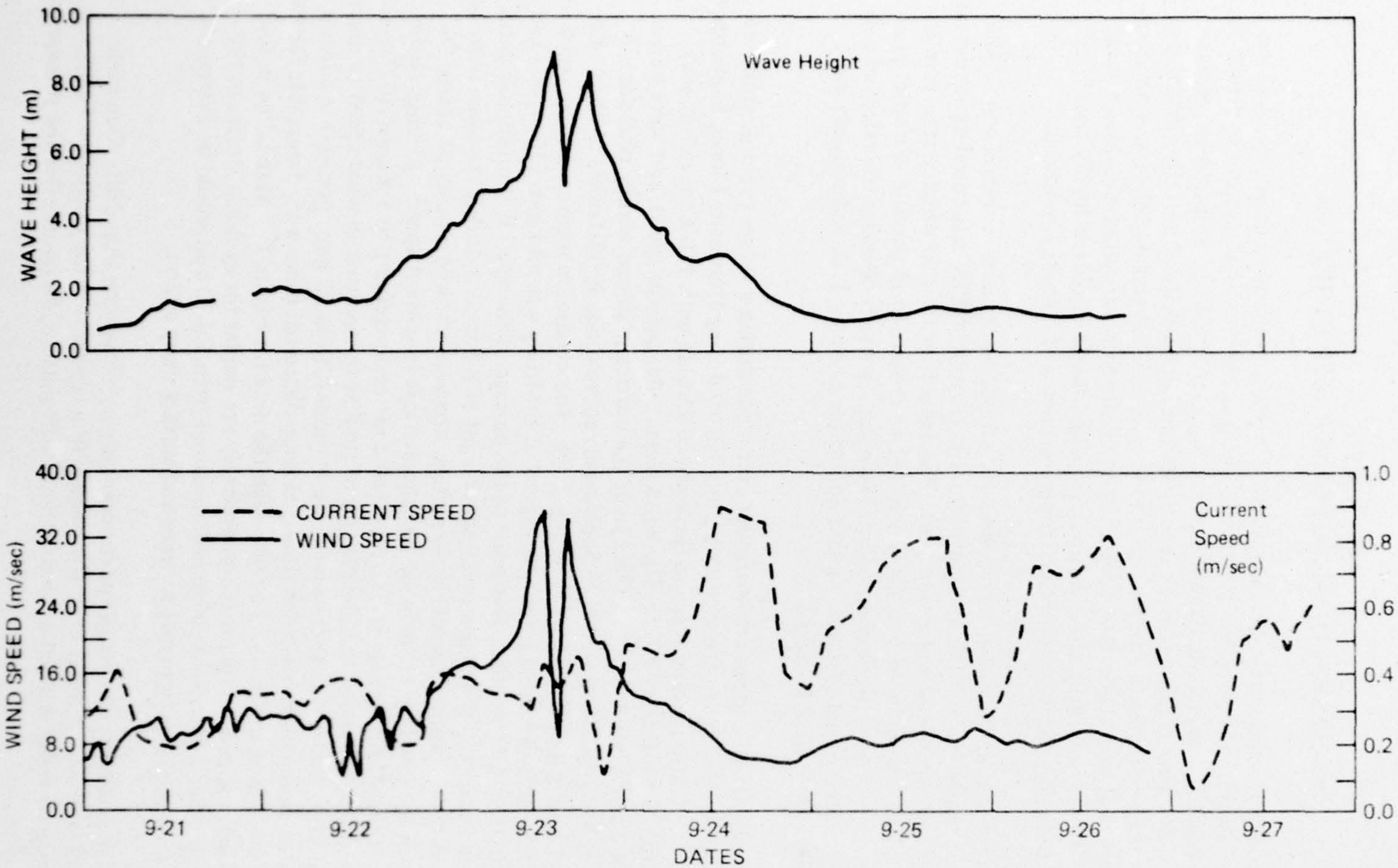


Figure E-1. Wind and current speed, and wave height measured from a NOAA buoy in the Gulf of Mexico during Hurricane Eloise, Sept., 1974. Position (a) denotes passing of the hurricane eye. (Data from the Data Buoy Office, NOAA, Ref. 53).

typhoon, approximating a 6-knot (3 m/sec) maximum drift (Ref. 54). Prior to the passage of the typhoon, the current drift was relatively straight to the northwest at 2 to 3 knots (1 to 1.5 m/sec). This demonstrates the dramatic change in both speed (2-3 to 6 knots) and direction (northwest to northeast) that can occur for a significant period of time after a hurricane.

Besides limited ship drift data and the single current measurement in the Gulf of Mexico reported above, no other data giving current measurements in severe storms could be located. Theoretical predictions of the effect of high winds on currents do exist, however; some of the available literature are given in Refs. 55 to 59. A recent paper by Forristall gives a detailed discussion of the three-dimensional structure of storm-generated currents (Ref. 60), where a theoretical model for three-dimensional wind-driven currents is also provided. The driving force comes from the boundary condition of wind shear at the surface. The model solution comes from two major steps: first, a two-dimensional finite difference scheme is used to solve for current transports and storm surge; second, the current profiles at selected points are calculated from convolution integrals, which may be evaluated given a wind stress and sea surface slope at those points.

Some of the important conclusions follow. Wind-driven waves generally produce the dominant forces on offshore structures; however, since the hydrodynamic force is proportional to the square of the water particle velocity, a current of a few feet per second can increase the total force by 50 percent over that caused by waves alone (Refs. 50 and 60).

Solutions for a hurricane in the Gulf of Mexico were derived. An example solution was conducted using given data from Hurricane Camile (August 1969). Surface currents as high as 15.5 knots (8 m/sec) were predicted; current speeds at other depths were as follows: 8.75 knots (4.5 m/sec) at 10 meters, 4.5 knots (2.3 m/sec) at 20 meters, 2.1 knots (1.1 m/sec) at 30 meters, and 1 knot (0.5 m/sec) at 50 meters. A current speed versus depth curve from these data are given in Fig. E.2. These velocities were predicted for a station a few miles east of the hurricane in 100 meters of water, based on a maximum wind velocity of approximately 122 knots (63 m/sec) and a maximum wave height of 22 meters (Ref. 61). The effect of sloping bathymetry was strong, producing primarily longshore currents, which for deep water OFEF's will not be a consideration; thus, open ocean surface currents may be somewhat less. The model demonstrates that a tight circular wind can spin the water column to velocities much higher than those generated by a linear wind, and that the outward flow at the surface is balanced by an inward flow near the bottom. P. Black (personnel communication) has estimated that there is an approximate 10:1 wind velocity to surface current speed ratio in severe cyclonic storms. The predicted current in Forristall's model above (Ref. 60) approximates this estimated ratio (122-knot winds to 15.5-knot surface current).

Because of the lack of measured data, models such as the one described above will have to be used to estimate the current field in the event of a storm in the vicinity of an OFEF. A program to obtain storm-generated current data has been started by the Shell Development Company, Ref. 50, and as data are reported they should be incorporated into OFEF engineering design. Table E.1 gives a list of personnel working in the wind-generated ocean current field for future contact as needed.

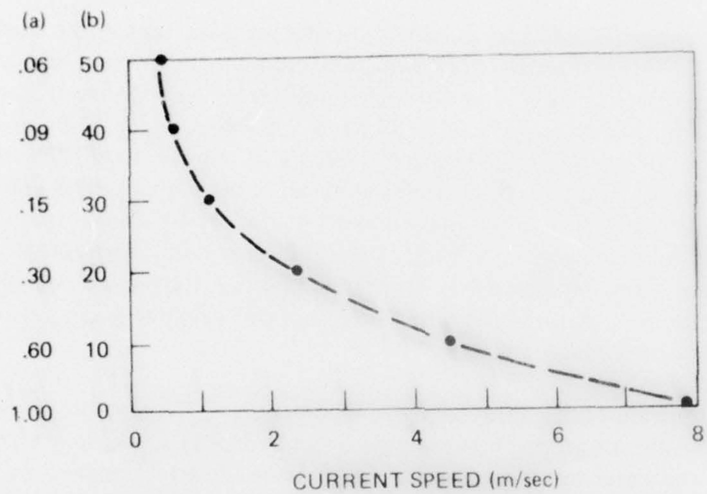


Figure E.2. Predicted current profile in the vicinity of Hurricane Camile with a maximum of 122-knot winds. (a) Ratio of current speed at given depth-to-surface current speed. (b) Depth of predicted current in meters. (Computed data from Forristall, Ref. 60).

Table E.1. Personnel working in the field of wind-generated ocean current measurement and theory.

NAME	AFFILIATION	STUDY AREA	PHONE
Vincent Cardone	New York University Inst. of Oceanography 675 W. 252 Street Bronx, NY 10471	Forecasting wave & current data.	212-796-8300
J. H. Hinchman	General Dynamics Electronics Division Ocean Systems, Engineer San Diego, CA	Current measurement & buoy development.	714-279-7301
Peter Black	NOAA National Hurricane Center Hurricane Environmental Meterological Laboratory Miami, Florida	Response of watermass to hurricanes.	305-350-4150

Table E.1. (Continued).

NAME	AFFILIATION	STUDY AREA	PHONE
Duncan Ross	Sea Air Interaction Lab. Miami, Florida		305-361-3361
George Forristall J. Michael Hall	Shell Development Co. Houston, TX	Storm-generated current modeling.	713-667-5661
Greg Wither Roy Clem	NOAA National Data Buoy Office Bay St. Louis, Mississippi	Current data from buoys.	601-688-2211
Meritt Stevenson	NOAA National Marine Fisheries Service S.W. Fisheries Center La Jolla, CA	Current measurement and modeling.	714-453-2820

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